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Perkins Electro-Acoustic Research Lab, Inc.   Engineering and Intuition Serving the Soul of Music

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CONTENTS

1 INTRODUCTION

1.1 GENERAL CONDITIONS AND WARRANTY

THANKS

Thank you for purchasing your SOFIA system. We hope that your experiences using SOFIA will be both productive and satisfying.

CUSTOMER SUPPORT

Audiomatica is committed to supporting the use of the SOFIA system, and to that end, offers direct support to end users. Our users all around the world can contact us directly regarding technical problems, bug reports, or suggestions for future software enhancements. You can call, fax or write to us at:

AUDIOMATICA SRL
VIA FAENTINA 244/G
50133 FLORENCE, ITALY
PHONE: +39-055-575221
FAX: +39-055-5000402

AUDIOMATICA ON-LINE

For having technical support, to get a list of international distributors, for any inquiry and to know the latest news about SOFIA and other Audiomatica's products we are on the Internet to help you:

E-MAIL: audiomatica@mclink.it
WWW: http://www.mclink.it/com/audiomatica

AUDIOMATICA'S WARRANTY

Audiomatica warrants the SOFIA system against physical defects for a period of one year following the original retail purchase of this product. In the first instance, please contact your local dealer in case of service needs. You can also contact us directly as outlined above, or refer to other qualified personnel.

WARNINGS AND LIMITATIONS OF LIABILITY

Audiomatica will not assume liability for damage or injury due to user servicing or misuse of our product. Audiomatica will not extend warranty coverage for damage of the SOFIA system caused by misuse or physical damage. Audiomatica will not assume liability for the recovery of lost programs or data. The user must assume responsibility for the quality, performance and the fitness of Audiomatica software and hardware for use in professional production activities.

Sofia and AUDIOMATICA are registered trademarks of Audiomatica SRL.

1.2 REGISTRATION CARD

AUDIOMATICA REGISTRATION CARD (MAIL OR FAX TO US)

SOFIA SERIAL NUMBER: ______________________________

SOFTWARE VERSION: ______________________________

PURCHASE DATE: ______________________________

NAME: ______________________________

JOB TITLE: ______________________________

COMPANY: ______________________________

ADDRESS: ______________________________

ZIP OR POST CODE: ______________________________

PHONE NUMBER: ______________________________

FAX NUMBER: ______________________________

2 THE SOFIA VACUUM TUBES CURVE TRACER

2.1 A GENERAL LOOK AT THE HARDWARE OF SOFIA

Sofia is housed in a stand alone box and is powered from the mains. On the top panel the most widespread tubes sockets are present, together with the routing system. Fig.2.1 shows Sofia's panel.

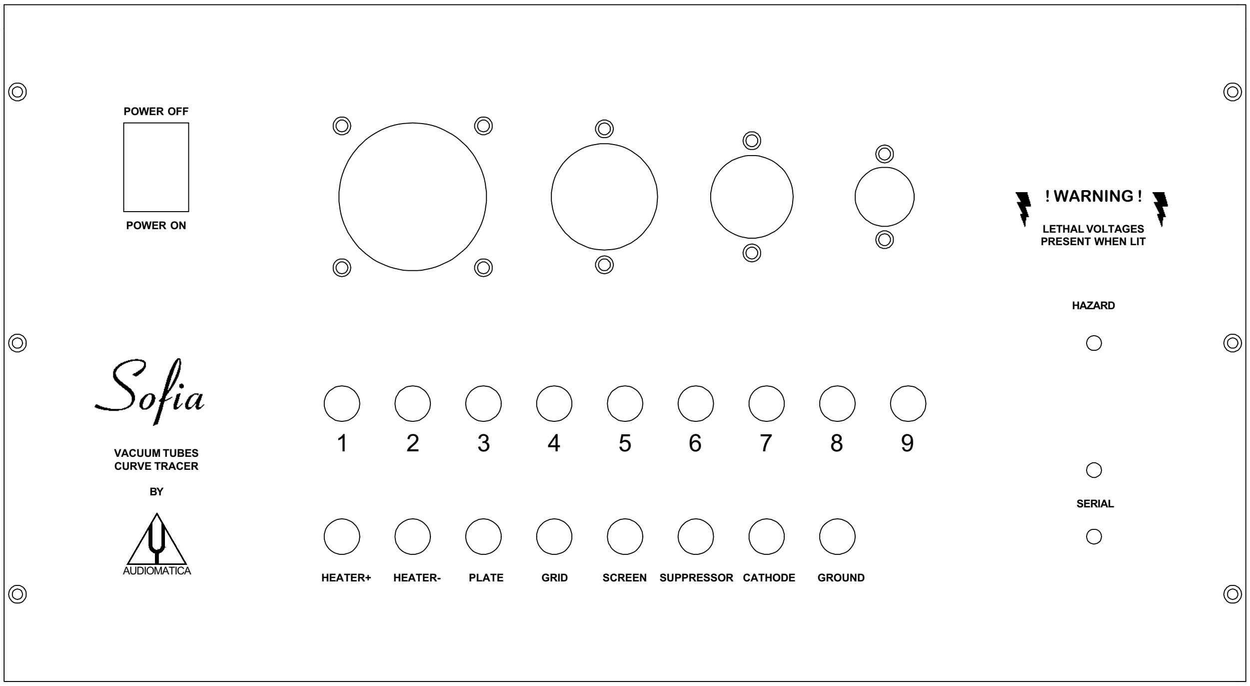


FIG.2.1 - Sofia's top panel

Heart of the system are four high resolution (16 bit) voltage generators for filament, plate, grid, screen grid and three high resolution (16 bit) milliamperometers used to resolve the currents involved in this kind of measurements. The achieved resolution together with gain control facilities for voltage and current allows to measure tubes curves with enormous dynamic range. State of the art circuitry and sophisticated digital control greatly enhance reliability, a main topic in high voltage devices. A microprocessor handles both the RS-232 link to the PC and the internal logic requirements. The flexible manual routing system makes easy the connection of tubes that don't fit in the sockets provided; furthermore allows several circuital configurations (cascode, srpp ...) to be evaluated as a single tube.

2.2 SOFIA 'S TOP PANEL

As you can see from Fig.2.1 Sofia's top panel comes with the following features:

- Four tube sockets (four, seven, octal, noval) internally wired to the numbered terminals.

- A manual routing system composed by several connecting cords.

- The coloured output terminals of the four voltage genarators and grounds.

- The RED HAZARD LED and the two yellow serial leds.

- The power switch.

CAUTION: SOFIA IS ABLE TO GENERATE VERY HIGH VOLTAGES THAT MAY CAUSE YOU SEVERE INJURIES; PAY ATTENTION TO THE RED HAZARD LED; WHEN THE HAZARD LED IS LIT DO NOT TOUCH THE INSTRUMENT.

The two yellow serial leds signal the occurring serial data transfer.

2.2 ACCESSORIES SUPPLIED

Sofia comes with the following:

- User's Manual and System Software
- 7 coloured connecting cords
- 1 splitting cord
- 1 AC mains cable
- 1 RS-232 9-to-9 pins connecting cable

2.3 SOFIA'S SYSTEM SOFTWARE

A powerful Windows™-like software with a mouse oriented user interface allows an immediate control over all the measure processes. Refer to the following chapters for a detailed description of its functionality.

Basic tubes parameters as transconductance, plate resistance and amplification factor are shown in real time for any operating area within the displayed curves. Sofia's system software handles tube directories containing all the manufacturer's mechanical data and electrical measurement limits. Automatic pass-fail QC control routines makes easy and quick any tube selection process. Automatic best match between couple or more tubes within a batch is also included.

2.4 TECHNICAL SPECIFICATIONS

DC GENERATORS

Type:	4 channels voltage generator
Resolution:	16 bit
Plate voltage range:	0÷700 V
Grid screen voltage range:	0÷700 V
Filament voltage range:	0÷24V
Filament max. supply current:	5 A
Grid voltage range:	+10÷-150 V

DC ANALYZERS

Type:	3 channels milliamperometer
Resolution:	16 bit

ROUTING SYSTEM

Type:	manual with supplied cords
Test sockets furnished:	- Octal
	- Noval
	- Four
	- Transmitting seven

PC CHARACTERISTICS REQUIRED

80286 or more

640 Kbytes RAM or more

VGA video adapter or more

Hard Disk

Free RS-232 port

Co-processor required

MISCELLANEOUS

Dimensions (approx.): 44x24x12 cm.

Weight: 7 Kg.

AC voltage: 110-120 220-240 V

AC power consumption: 200W

3 INSTALLING AND USING SOFIA

NOTE: PLEASE REFER TO CHAPTER 4 FOR POTENTIAL PROBLEMS REGARDING THE COMPATIBILITY OF SOFIA WITH YOUR PC (EITHER HARDWARE OR SOFTWARE).

3.1 PC CONFIGURATION

SOFIA can be connected to any IBM (or compatible) personal computer with the following mimimum system requirements:

– 286 processor
– one free RS-232 serial port available
– 640 kB RAM
– hard disk
– VGA video board
– MS-DOS Version 3.2 or later

A math coprocessor is highly recommended although not necessary.

3.2 HARDWARE INSTALLATION

This installation is as simple as connecting the SOFIA cabinet to the AC mains and to a free serial connector of your PC with an appropriate serial cable.

WARNING: before connecting SOFIA to a wall AC outlet make sure that your unit is properly set for AC voltage; in case of any doubt refer to your local assistance.

WARNING: depending on the connector of RS-232 port use either the supplied 9-to-9 pins serial cable or a 25-to-9 pins serial cable or a 25-to-9 pins BIDIRECTIONAL RS-232 adaptor: DO NOT use 9-to-25 pins mouse adaptors, the connection would not work.

CAUTION: SOFIA IS ABLE TO GENERATE VERY HIGH VOLTAGES THAT MAY CAUSE YOU SEVERE INJURIES; PAY ATTENTION TO THE RED HAZARD LED; WHEN THE HAZARD LED IS LIT DO NOT TOUCH THE INSTRUMENT.

3.3 SOFTWARE INSTALLATION

The SOFIA software is provided on a 3.5" (1.44 MB) diskette named “PROGRAM DISK”.

The software has to be installed on the hard disk of your PC. The installation procedure is carried out by running the INSTALL.BAT batch file that is supplied on the program disk. This will create a SOFIAxx directory and one subdirectory called DATA. “xx” denotes the software version number. For this edition the actual version number is 1.0, so a SOFIA10 directory will be created.

To install the SOFIA software do the following:

1) Insert the “PROGRAM DISK” in your PC.

2) Type the following command:

   INSTALL {*optional source drive*}{*optional destination drive*}<ENTER>

where {*optional drive*} is, for example, A: or D: and <ENTER> indicates that you should press the Enter key on your keyboard.

As an example "INSTALL B: D:" installs SOFIA from drive B: to drive D:; if you only specify "INSTALL" without arguments SOFIA will assume A: source drive and C: destination drive.

The DOS PATH should not contain the C:\SOFIA10 path; SOFIA has not to be run from outside the SOFIA10 directory! SOFIA requires at least 575K of conventional memory; use the appropriate DOS command to check this requirement before running SOFIA.

3.4 RUNNING SOFIA FOR THE FIRST TIME

If you have successfully completed the preceding installation procedures, you are ready to run SOFIA!

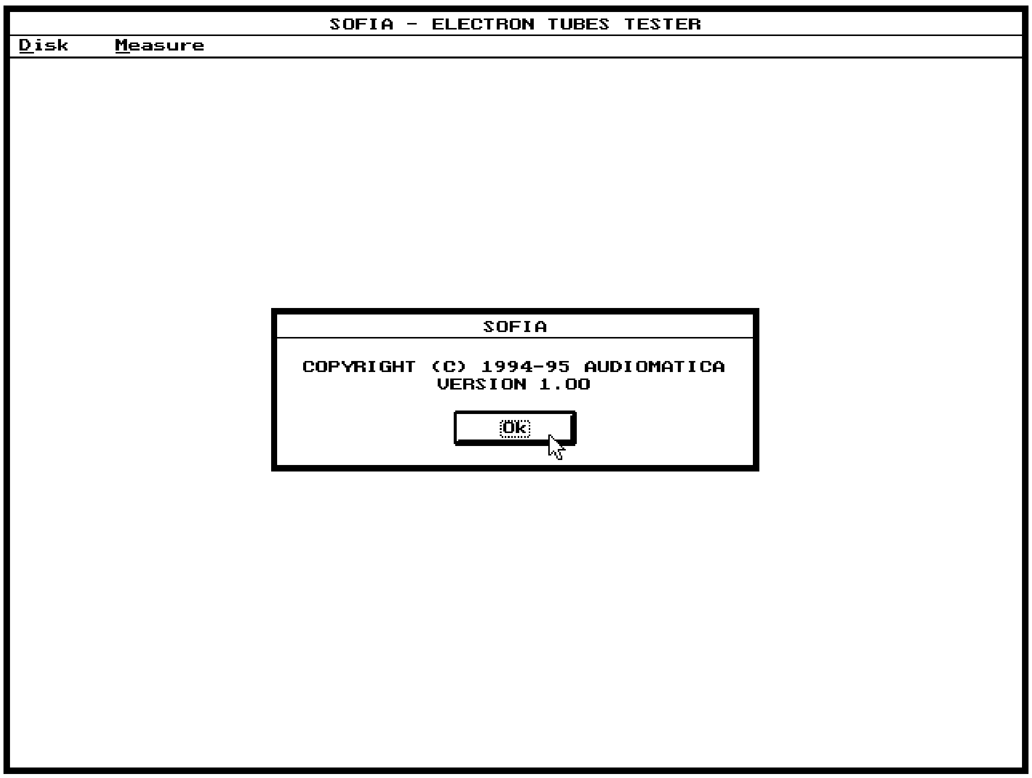


FIGURE 3.1 – SOFIA's main window

Switch SOFIA on and, in order to run the software, just type SOFIA and <ENTER>. You should see SOFIA's main window (Fig. 3.1). After having answered the initial prompt you are ready to make your first measurement.

Should there be any problem with the installation the program will display a warning message. In the event that a warning message does occur, please refer to section 7.3.3 to properly setup the serial link.

We will now deal with a guided example that shows how to connect and measure a tube. The first assumption is that you have a tube in your hands; we will think that it is a common 6DJ8 (or an equivalent 6922 or ECC88 or E88CC etc. etc.) twin triode.

Make sure that SOFIA's connection system is free from any connecting chord and insert the tube in the noval socket; press M and then <ENTER>: you will see, for the first time, the Measure Plate

control panel (Fig.3.2); now press F1: the Tube data dialog box will appear (Fig.3.3) and you have learnt the usage of the F1 Hot Key, refer to chapter 5.4 for a list of all the other active Hot Keys; from the list of available tubes data files select the 6DJ8.TBE one either double-clicking on it or first selecting it and then pressing L to load it; the pin description available for this tube will lead you in the proper manual configuration of the connection system; let's start from turning on the tube: take the two chords with white plugs and, as described in the PIN 4 and PIN 5 fields (FIL stays for filament

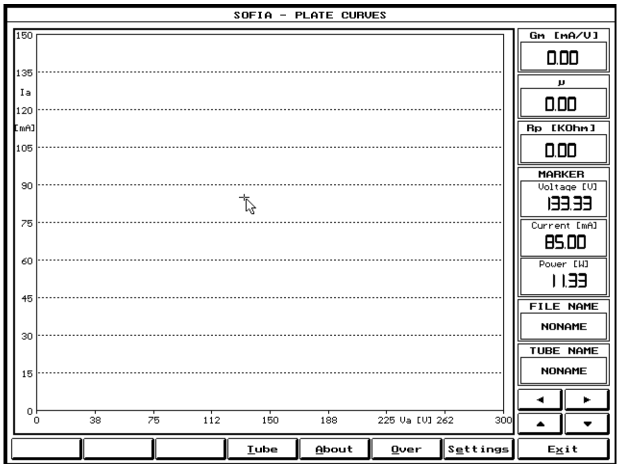


FIGURE 3.2

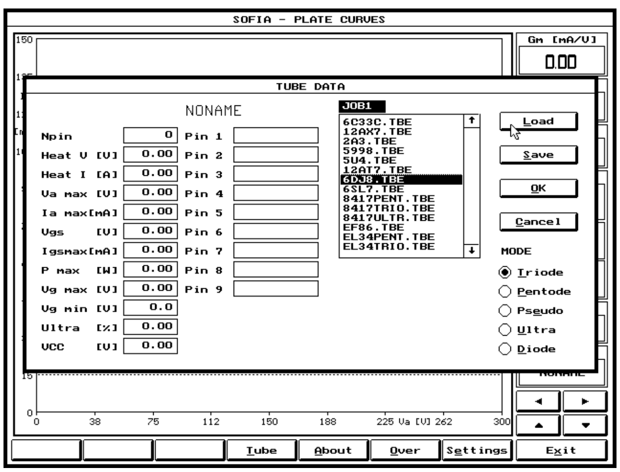


FIGURE 3.3

but one may write HEATER or whatever), make the following connections:

HEATER+	⇨	④
HEATER-	⇨	⑤

Now press O for **<u>O</u>**k: the Tube data dialog box disappears and the Start, Fil and Dual function buttons are now active; note also that the Tube Name box shows the correct 6DJ8 name; press F: the filament function button is now active and the tube should be heated, you should see the serial leds flashing for a few seconds and then a reassuring ligth coming from the filament of your tube; shuold this not happen check all the procedure again starting from the beginning .

We have now to connect the remaining tube terminals; press F1 again, the pin description tells us to make the following connections (with the chords with red, green and black plugs):

PLATE	⇨	①
GRID	⇨	②
CATHODE	⇨	③

Press <ESC>: we're now ready to start the first measurement.

CAUTION: SOFIA IS ABLE TO GENERATE VERY HIGH VOLTAGES THAT MAY CAUSE YOU SEVERE INJURIES; PAY ATTENTION TO THE RED HAZARD LED; WHEN THE HAZARD LED IS LIT DO NOT TOUCH THE INSTRUMENT.

Press S; the measurement is now running and after about 30 seconds you will be prompted with the output plate characteristics of your tube (Fig. 3.4)!

You can now freely inspect this family of output curves by means of the cursor dragging it with the mouse; the software will calculate, in real-time, and display in the status area at the right of the measurement screen the values of Gm, Mu, Rp, Voltage, Current and Power of the selected point.

Now press F2: you can save the measurement to a file on the hard disk; to recall it later use F3.

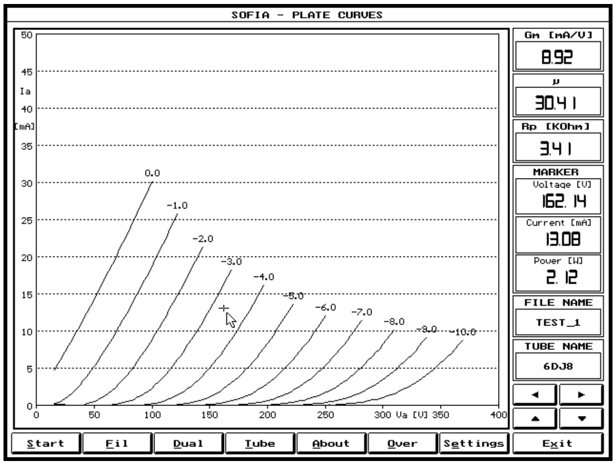


FIGURE 3.4

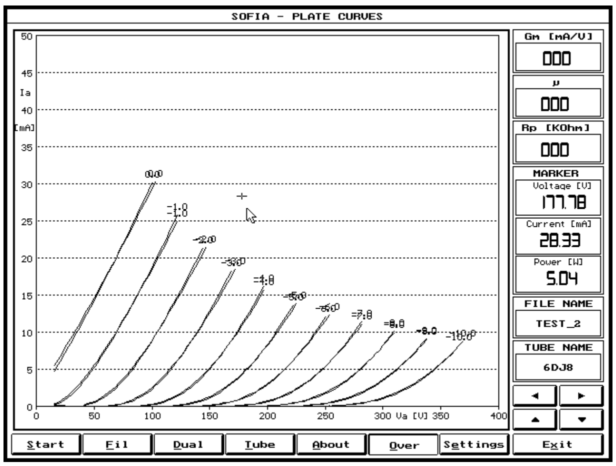


FIGURE 3.5

To complete the 6DJ8 measurement we have to measure the second triode section; press F1 and check for the following connections:

PLATE ⇨ ⑥
GRID ⇨ ⑦
CATHODE ⇨ ⑧

Before starting the new measurement press O; this will activate the Overlay mode so that both families of curves will be displayed simultaneously; press S to measure the second triode of your tube; the final situation should be like in Fig.3.5 with the complete characterization of the tube on the screen; you will learn later how to measure both sections of the tube together using the Dual measuring mode and a particular connection.

3.5 ADVICES

We suggest you to take some time for reading the User Manual and familiarize with SOFIA's functionality.

Particular attention has to be paid to paragraph "5.4 HOT KEYS"; learning the hot keys will save you time during your job and enhance your productivity.

4 PC COMPATIBILITY

4.1 HARDWARE COMPATIBILITY

Provided the availability of a standard RS-232 serial port Sofia has not showed, at the moment, any problem regarding compatibility with IBM-PC or compatibles personal computers.

4.2 SOFTWARE COMPATIBILITY

A brief note is due regarding the Windows95 environment:

The Sofia software program is NOT a Windows application; the performances and characteristics described in this manual are guaranteed under the assumption that the program is run under a DOS session.

5 SOFIA'S USER INTERFACE

5.1 GENERAL INFORMATION

SOFIA's user interface has been created by embodying many modern concepts relating to the design of graphical user interfaces for programs running on personal computers. Many of these ideas have been implemented in products such as the Microsoft Windows graphical environment, which has enjoyed a high degree of acceptance by computer users. With such a philosophy as an inspiration, which today is a commonly recognized standard, the SOFIA program should be easy for the user to comprehend and operate.

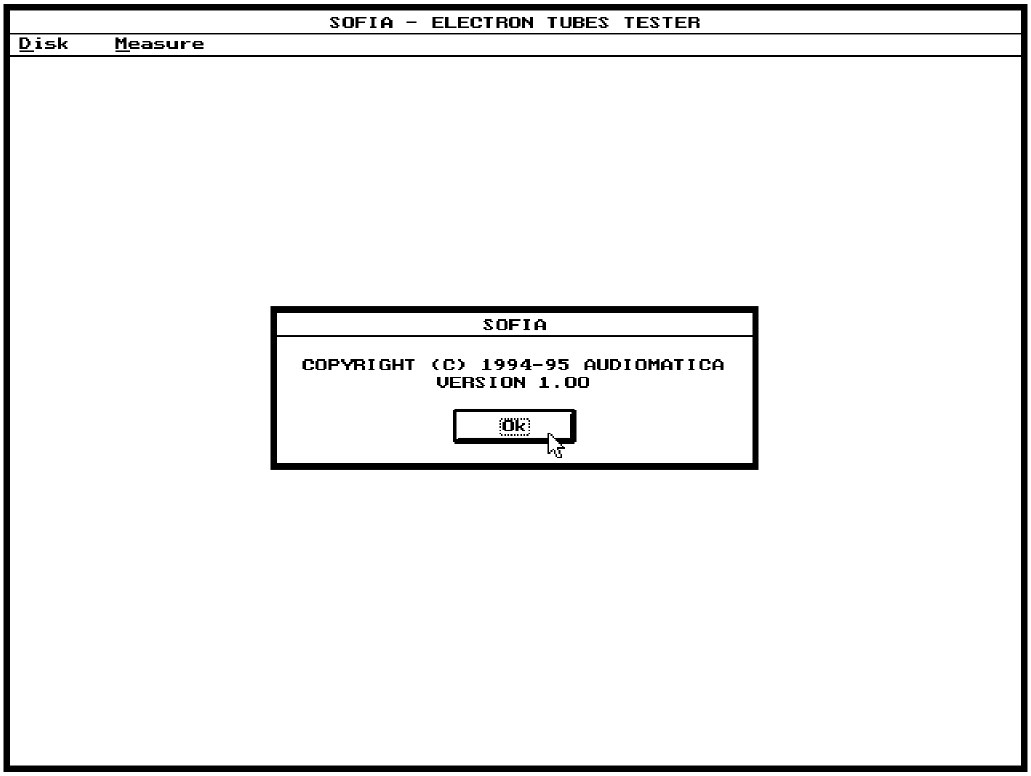


FIGURE 5.1 – SOFIA's startup screen and user interface

Fig. 5.1 shows SOFIA's initial screen. Aside from normal graphical user interface objects such as menus, scroll bars, dialog boxes, radio buttons, etc., SOFIA's user interface furnishes a comfortable work area via a control panel. This has been developed to make the PC screen as similar as possible to a traditional instrument (see section 5.3), and the contents of each control panel will change depending on the particular task that is to be carried out.

NOTE: What has just been said does *not* mean that SOFIA is a Windows application; SOFIA is a native DOS application and cautions should be taken when running it under Windows: refer to chapter 4 for any detail aboyut this topic.

Let us now move on to describe in detail the most important user interface objects that one will meet when working with SOFIA.

5.2 MENUS

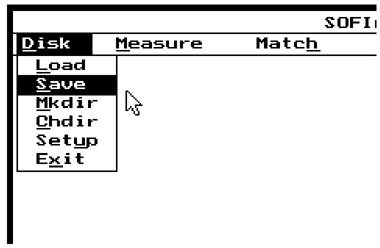


FIGURE 5.2

Menus allow a number of operational choices to be gathered into specific subject categories. They are structured in a hierarchical "upside-down tree" manner (as are the directories of a disk). SOFIA's main window, which is a menu in itself, is at the highest level (equivalent to the root directory of a disk).

Choices may be made by either positioning the mouse or by entering the underlined letter by means of the keyboard, or by moving the highlighted bar with the arrow keys and making the selection with the Enter key.

It is possible to exit from all menus by simply pressing the Esc key.

5.3 CONTROL PANELS

Fig. 5.3 shows a typical control panel.

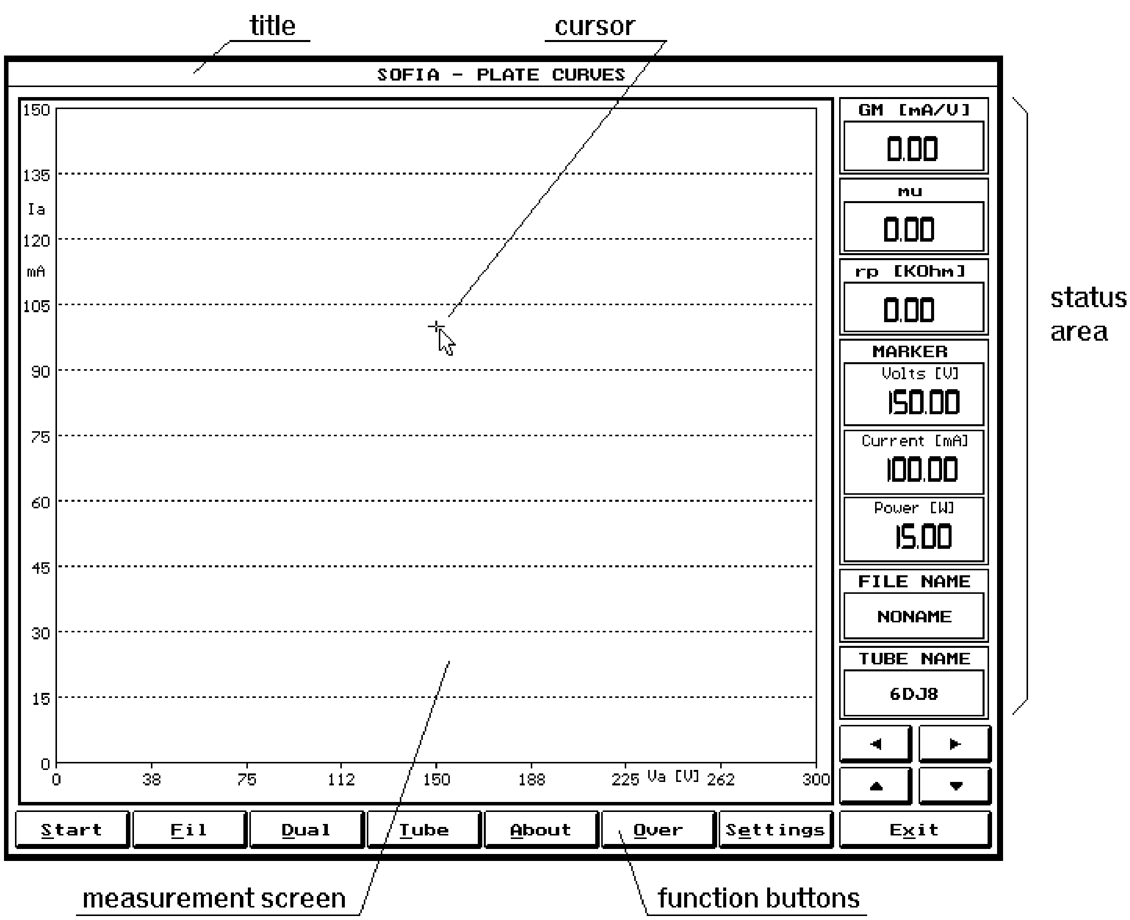


FIGURE 5.3 – A typical control panel

In general, the screen will be divided into three physically and functionally distinct areas. Within the graphical window, whose title gives the name of the control panel, the following regions are present:

THE MEASUREMENT SCREEN

This represents the screen of a traditional instrument, and it occupies the major part of the window and presents the results obtained from the measurement that was executed.

NOTE: It is normally possible to check results of a measurement through the use of an on-screen cursor. This can be directly activated with the mouse (dragging is possible by keeping the left button pressed). The numerical values associated with a given point on the graphical plot will usually be written on the status line (see above).

FUNCTION BUTTONS

These are found immediately under the measurement screen, and they represent the buttons that might normally be present on the instrument's panel. Each button has a label that serves to describe its function. By selecting these buttons, it is possible to execute the measurement and check parameters.

These function buttons may be "pressed" by positioning the mouse pointer on top of the selected function button and then clicking the left mouse button. It is also possible to make a selection by pressing the key on your keyboard that corresponds to the underlined letter on the button label.

There are two different kinds of buttons. The most common one immediately returns to the starting position after being pressed, and this kind of button serves to confirm an action. The other type of button remains active when it is pressed, and changes colour to confirm that a particular operational mode has been selected. To deactivate such buttons it necessary to press them a second time.

THE STATUS AREA

This is located either between the function buttons and the end of the graphics window or at the side to the rigth of the measurement screen, and it is used to present useful messages to the user that help to enhance the understanding of the measurement. For example, these status messages include such things as the file name, the input overload status, the cursor's position, as well as many others.

5.4 HOT KEYS

These are the keyboard keys that are always active from within any menu or control panel. They are a quick and convenient way to execute many of the most commonly used operations. They are not visible and therefore may not be selected with the mouse. After frequent use, these keys should become easy to remember. Let us now take a look at them in detail:

F1 Recalls the tube data dialog box.

F2 Saves the measurement on disk and activates the Save menu option. See section 6.4.

F3 Loads a measurement and activates the Load menu option. See section 6.3.

F4 Recalls the instrument control panel.

F5 Used to change the working directory; activates the Chdir menu option. See section 6.6.

F6 Creates a new directory on disk; activates the Mkdir menu option. See section 6.5.

Alt-P Prints the executed measurements from within any control panel. To select the print options refer to the SOFIA SETUP chapter.

6 DISK MENU

6.1 INTRODUCTION

As you might expect from its title, this chapter deals with the functions that result in read or write access to and from the hard disk. Setup and Exit functions, although not logically tied to disk operations, are also present in this menu as they are of such common use.

Before we begin examining each item on this menu, we strongly recommend that you read through the chapter describing the use of SOFIA's "hot keys." Amongst other things, the hot keys allow the Load and Save commands to be quickly accessed from every other menu in the program.

6.2 DATA FILE ORGANISATION

The SOFIA program is organised in a rather rigid structure on the hard disk, and this does not allow the user to wander around the directories. Data files containing measurements obtained by the user are gathered under the DATA subdirectory (which must in all cases be named as such), and under further subdirectories which the user may define whose prototype is the JOB1 directory (also obligatory). The JOB1 subdirectory is automatically created by the installation program.

At the same level as that of the JOB1 directory, other directories may be created from within SOFIA by means of the Mkdir menu option found under the Disk command on the main menu bar. After a new directory has been created it may be made current through the Chdir menu option. All data files will be loaded or saved within the current directory.

Last but not least, it is not possible to remove any kind of file and load or save on files on floppy disks from within the program.

6.3 Load

By selecting this choice, the "Load File" dialog box, dedicated to those files belonging to the current subdirectory, will open (see also the F3 hot key). As shown in Fig. 6.1, this dialog box displays a list of files all of which have the same extension, and a series of buttons is used to select the extension (or rather the kind of measurement). These buttons are found on the bottom part of the window, and

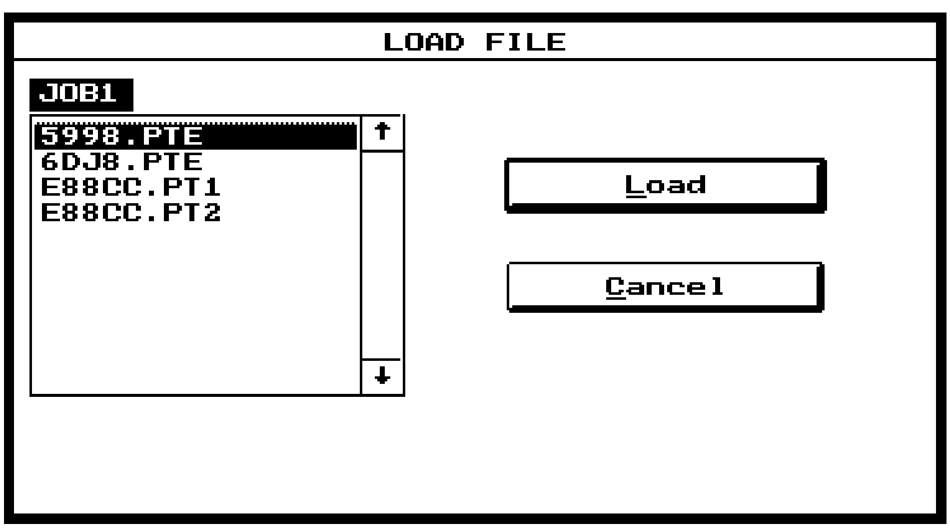


FIGURE 6.1 – The Load File dialog box

the Load and Cancel buttons are located towards the right hand side.

The file name extensions that can be used are:

Pte: measurement files obtained through the Measure Plate menu.

Pt1: measurement files obtained through the Measure Plate menu in Dual mode.

Pt2: measurement files obtained through the Measure Plate menu in Dual mode.

To load the desired file, select it by using either the arrow keys on the keyboard or the mouse. Then either click the Load button, press the underlined letter L, or give a double-click with the mouse on the selected file name in the file list. It is possible to load, in sequence, files of all types, and these will be plotted once the related control panel has been accessed.

6.4 Save

In Fig. 6.2 we can see the Save File window. The mode of operation is the same as that described for the Load File window. As might be expected, the filename extensions are also the same. You will automatically be prompted for the name of the file to be saved.

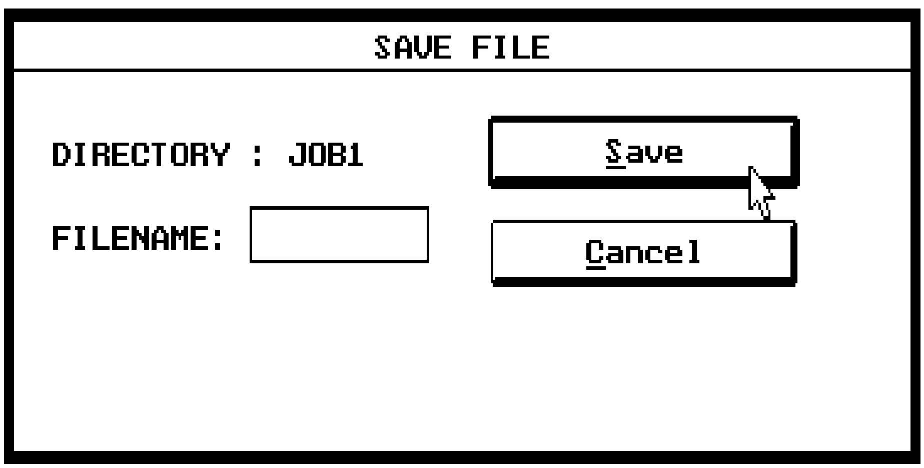


FIGURE 6.2 – The Save File dialog box

Should there already be a file with the same name and extension, you will be asked to confirm the save operation. The directory in which the file is saved is the current active directory (see the Chdir and Mkdir menu commands for further details). Aside from the measurement itself, additional relevant information will also be saved. This includes a comment that can be added by means of the About button, as well as several settings related to the measurement.

6.5 Mkdir

This command creates new work subdirectories that will be put under the DATA directory. All new directories are at the same level as the JOB1 directory which is created by the installation program. Therefore, it is possible to place sets of measurements into different subdirectories. When the SOFIA program is first loaded, the default directory where measurements and files of all extensions are saved is JOB1.

6.6 Chdir

This command is used to change the current directory where all measurements and files with different extensions will be saved to or loaded from. In order to be able to change to a particular directory, it must of course exist, and it will usually have been created using the Mkdir command.

When exiting from SOFIA, the current directory will be saved in the SOFIA.STP file. When the SOFIA program is re-loaded, the last selected directory will be automatically selected.

6.7 Setup

Refer to Chapter 7 "SOFIA SETUP" for a detailed explanation of this choice.

6.8 Exit

This command ends the SOFIA work session.

7 SOFIA'S SOFTWARE SETUP

7.1 INTRODUCTION

This chapter explains how to correctly configure the SOFIA system software in order to obtain the best results when performing tubes parameters measurements. Section 7.2 will deal with some software configuration issues related to the SOFIA board that will affect all measurements. Section 7.3 will cover various aspects of configuration that are related to the PC platform (eg. printer devices) and are usually found in all software products.

7.3 THE DISK Setup CHOICE

After choosing Setup from within the Disk command presented on the menu bar, one enters the Setup dialog box, which is shown in Fig.7.1. It is possible to configure your printer, on-screen colors, as well as SOFIA's serial connection from the various parameters displayed in this dialog box.

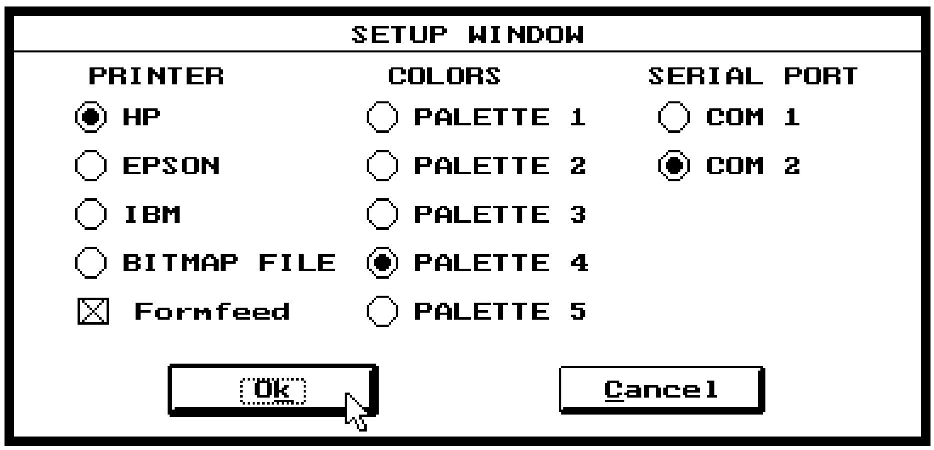


FIGURE 7.1 - The Disk Setup dialog box

7.3.1 PRINTERS

It is possible to select one of three popular printer families: Hewlett-Packard (HP), Epson, and IBM; otherwise the printout can be redirected to a standard Windows ".BMP" black-and-white bitmap file. It is also possible to set an option via a check box to send a form-feed command after each measurement is printed.

7.3.2 COLORS

This option lets the user select from one of five different color choices.

NOTE: Palettes 4 and 5 have been developed for use with monochrome displays.

7.3.3 SERIAL PORT

It is possible to configure the serial port (COM1 or COM2) to which SOFIA is connected.

7.4 THE SETUP FILE

All the above mentioned software configuration items are saved in a setup file called SOFIA.STP

that is saved in the main SOFIA directory. This file will be loaded automatically every time SOFIA is started, thus re-configuring it to the last used state.

NOTE: If, for any reason, you want to return to a known default condition, you can delete the SOFIA.STP file. This will cause the SOFIA software to load a built-in default configuration.

8 MEASURE MENU

8.1 INTRODUCTION

By selecting the Measure command from the main menu bar, it is possible to carry out tubes measurements and quality control.

8.2 MEASURE PLATE CONTROL PANEL

Fig. 8.1 shows the layout of the Measure Plate control panel.

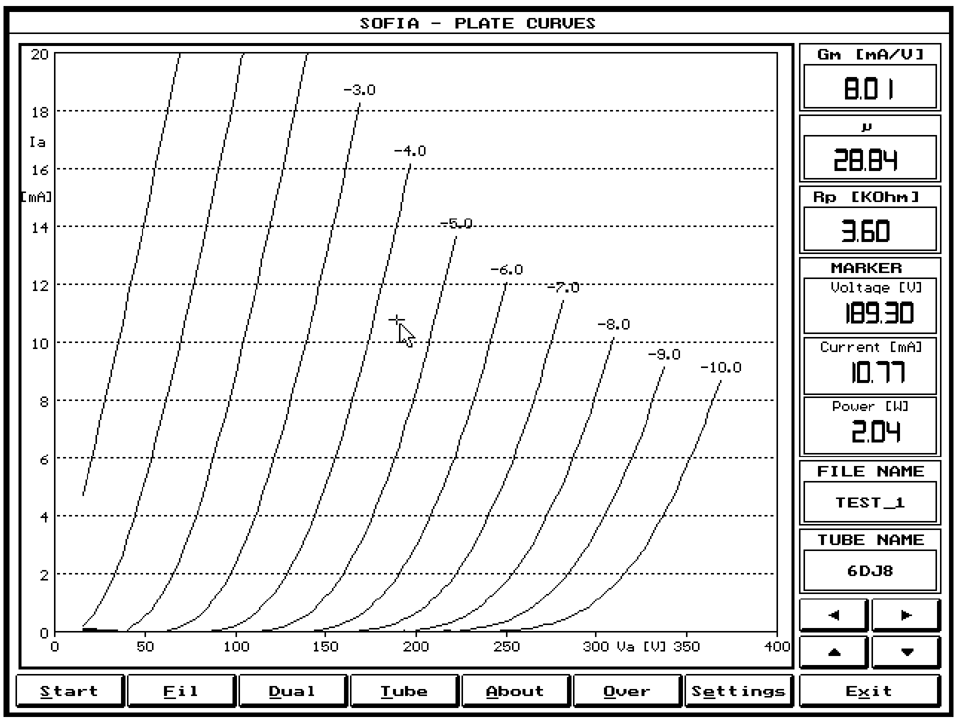


FIGURE 8.1 – The Measure Plate control panel

NOTE: When saving or loading files from disk in this control panel, always remember that the file extension connected to this measurement are ".PTE", ".PT1" and ".PT2". These extensions will be used automatically when you are working from within the Measure Plate control panel.

8.2.1 FUNCTION BUTTONS

<u>S</u>tart Starts a new tube measurement. See paragraph 8.2.4 for a description of how to measure a tube.

<u>F</u>il Turns the heater on.
NOTE: to obtain the maximum precision of the filament voltage it is recommended to turn the filament on ONLY AFTER having inserted the tube in its socket: this is due to the current sensing mechanism involved during the warm-up time. If you insert a tube in its socket with the filament on the voltage may be slightly different if its filament current is different from the filament current of the previous tube heated.

Dual — Turns the Dual mode on. See paragraph 8.2.5.

Tube — Used to access the Tube Data dialog box. See paragraph 8.2.2.

About — Used to insert or display a text comment describing the present measurement. The comment will be saved with the measurement.

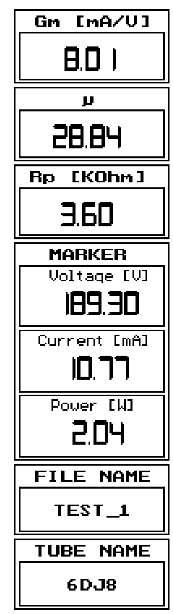
Over — Activates the overlap mode allowing for the overlaying of multiple curves. The visualised curves will be managed within a 2-location FIFO (first-in-first-out) buffer.

S**e**tting — Enters the measurement settings dialog box.

E**x**it — Exits the Measure Plate control panel.

→ ← ↑ ↓ — By pressing the arrow keys, or clicking on the corresponding buttons it is possible to change the displayed graphic scale for voltage and current.

Ctrl→Ctrl← — These keystroke combinations lets you ZOOM the displayed curves changing the left scale reference.



8.2.2 THE STATUS AREA

Located to the right side of the Measure Plate control panel gives the following information:

- Real-time calculation of Gm, μ and Rp related to marker position.
- Real-time display of voltage, current and power related to marker position.
- Name of measurement data file.
- Name of Tube Data file.

8.2.3 THE TUBE DATA DIALOG BOX

From this dialog box is possible to manage, edit and display all the electrical and mechanical data of the tube under test.

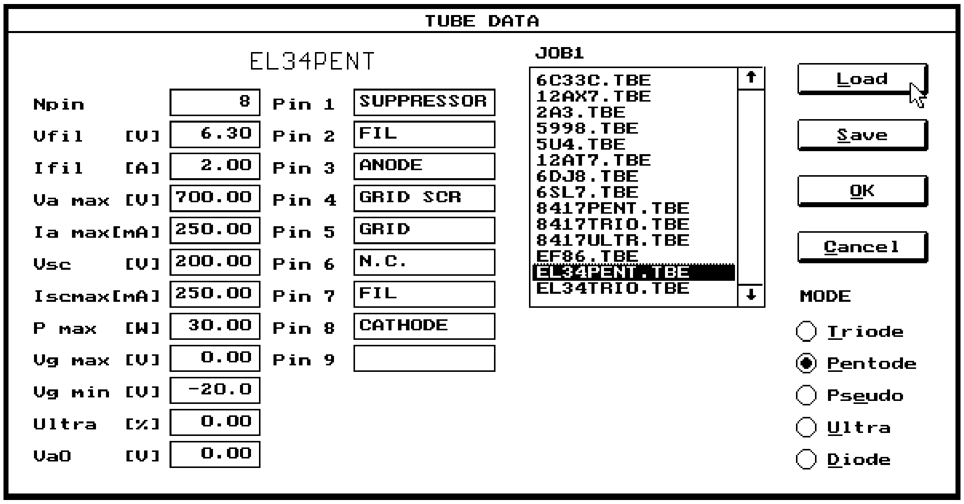


FIGURE 8.2 – The Tube Data dialog box

NOTE: When saving or loading files from disk in this control panel, always remember that the file extension connected to this measurement is ".TBE". This extension will be used automatically when you are working from within this dialog box.

WARNING: Audiomatica will not assume liability for the contents of the Tube Data files supplied in the distribution disk. These files are only meant as EXAMPLE files and descend from Audiomatica's experiences applied to tubes testing. ALWAYS refer to manufacturer's technical manual for exhaustive tube characteristics.

Load Loads the selected tube data file from disk.

Save Save the current tube data to disk.

Ok Exits the tube settings dialog box accepting the displayed data.

Cancel Exits the tube settings dialog box without accepting the displayed data.

Pin 1-9 Description of the tube pins; useful to make the right connections on the SOFIA front panel.

Mode Selects the kind of tube from within the following (see also 8.4):
- Diode
- Triode
- Pentode (also included are tetrodes)
- Pentode in pseudo-triode configuration
- Pentode in ultra-linear configuration

See paragraph 8.4 for a detailed description of how Sofia behaves when these choices are made.

Npin Tube number of pins.

Heat V	Heater nominal voltage.	[0÷24 V]
Heat I	Heater nominal current.	[0÷5 A]
Va max	Plate maximum test voltage.	[0÷700 V]
Ia max	Plate maximum test current.	[0÷270 mA]
Vsc	Screen test voltage. When in Ultra-Linear mode reference screen quiescent voltage (see 8.4.2).	[0÷700 V]
Isc max	Screen maximum test current.	[0÷270 mA]
P max	Total test power dissipation (Plate + Screen).	[0÷80 W]
Vg max	Grid maximum test voltage.	[+10÷-150 V]
Vg min	Grid minimum test voltage.	[+10÷-150 V]
Ultra	Percentage of the Ultra-Linear mode (see 8.4.2).	[0÷100 %]
Va0	Reference plate quiescent voltage in Ultra-Linear mode (see 8.4.2).	[0÷500 V]

Please note that, referring to the parameters ranges, the zero value is never allowed as input (except for Vgs, Igs and Va0); in these cases input a value grater than zero.

8.2.4 THE MEASUREMENT SETTINGS DIALOG BOX

Is used to input some settings useful during the measurement.

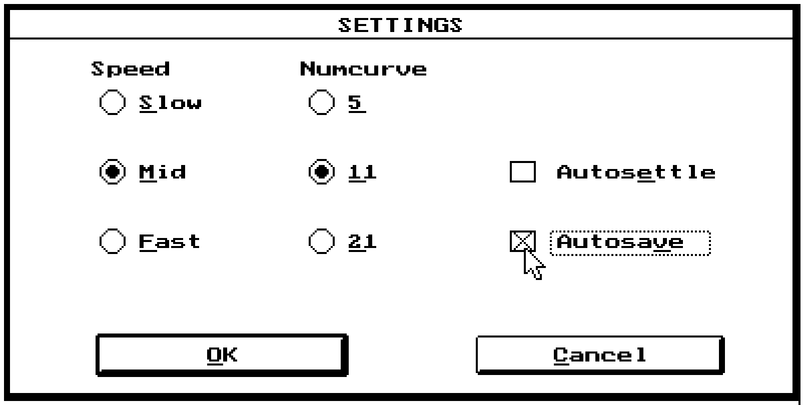


FIGURE 8.3 – The Measurement Settings dialog box

Speed — Selects the measurement speed. A different speed is obtained taking a different number of measurement points; the slower the speed the more accurate the curve measured.

NumCurve — Selects the number of curves that are measured, displayed and saved.

Autosettle — Tells Sofia to do the following things before starting a new measurement:
- wait for a stable filament current
- force the tube to a situation of maximum dissipation (in respect of what saved in the tube data)
- wait for the parameters to be stable in this condition

Autosave — Tells Sofia to automatically save the measurement to disk in the current work directory. Files are saved with progressive names as "TUBExxxx.PTx" where xxxx is an ascending number; the first file will be "TUBE1.PTx" and so on. If there are already autosaved files in the directory the program will search for the first available free number and use it.

8.3 HOW TO MEASURE A TUBE

CAUTION: SOFIA IS ABLE TO GENERATE VERY HIGH VOLTAGES THAT MAY CAUSE YOU SEVERE INJURIES; PAY ATTENTION TO THE RED HAZARD LED; WHEN THE HAZARD LED IS LIT DO NOT TOUCH THE INSTRUMENT.

This guided example explains the basic steps involved in measuring a vacuum tube:

- Input of the electrical and mechanical data in the tubes archive.
- Connection of the tube to Sofia's terminals.
- Measurement carrying out and management.

8.3.1 INPUT OF ELECTRICAL AND MECHANICAL DATA

Provided you have a vacuum tube in your hands, the first thing that you have to do is to tell Sofia its main electrical and mechanical data (see also 8.2.2); suppose you are dealing with an EL34 (or an equivalent 6CA7) beam pentode. If you take a look to the list of data files supplied with the distribution disk you may want to use the "EL34PENT.TBE" one (as in fig.8.2) or take a technical manual like Sylvania one and either control that the data in the existing file are correct or write a new one and save it to disk. Your experience will guide you to the best interpretation of the data in manuals so that all potentiality of Sofia will be applied to tube testing.

NOTE: The impulsive technique exploited by Sofia when measuring families of curves lets usually extend the maximum dissipation beyond the value encountered in technical manuals; the power dissipation data in manuals are usually given in continuous drive conditions.

WARNING: Audiomatica will not assume liability for the contents of the Tube Data files supplied in the distribution disk. These files are only meant as EXAMPLE files and descend from Audiomatica's experiences applied to tubes testing. ALWAYS refer to manufacturer's technical manual for exhaustive tube characteristics.

8.3.2 CONNECTION OF TUBE TO SOFIA'S TERMINALS

The second step required is the electrical connection of the tube to Sofia; this is done first inserting the tube in the appropriate socket and then manually making the connections with the supplied connecting cords. Fig.8.4 shows the connection for the EL34 pentode.

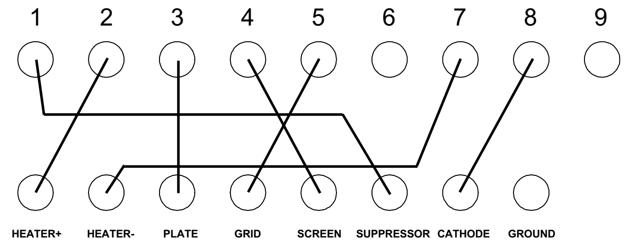


FIGURE 8.4 – EL34 connections

8.3.3 MEASUREMENT CARRYING OUT AND MANAGEMENT

Should the first two steps be carried out one is now ready to perform the tube measurement. The measurement settings described in 8.2.3 and the status of the control panel function buttons together with the previously loaded Tube Data determine how the measurement will be done and managed.

Before starting the actual measurement the tube has to be turned on; this is done by pressing the Fil function button thus delivering current to the tube heater.

NOTE: it is good practice, before starting the measurement, to take a look at the tube and be sure that the filament is correctly powered; after the normal heater warm-up time (usually given in technical manual) you should see the reassuring red light coming from the heated element.

WARNING: if you are not sure that the filament is on DO NOT PROCEED with measurement; this could lead permanent damage to the tube and eventually to Sofia. The following procedure is recommended should you be in troubles at this point:

- Turn the filament off by pressing the Fil button.

- Replace the cord from the HEATER+ terminal with the splitting cord.

- Turn the filament on again and measure, with a voltmeter, the filament voltage between the HEATER+ and the GROUND terminals; refer to Fig.8.5 for connections.

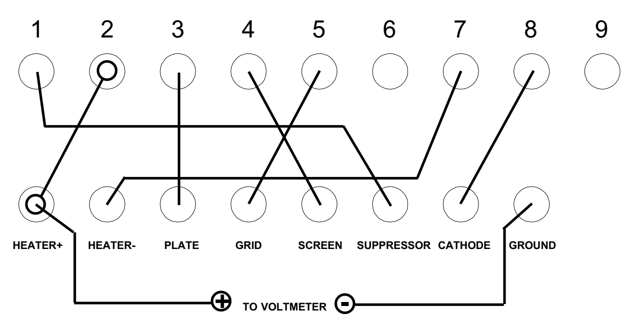


FIGURE 8.5 – Connections to verify filament voltage

NOTE: to obtain the maximum precision of the filament voltage it is recommended to turn the filament on ONLY AFTER having inserted the tube in its socket: this is due to the current sensing mechanism involved during the warm-up time. If you insert a tube in its socket with the filament on the voltage may be slightly different if its filament current is different from the filament current of the previous tube heated.

If your tube is correctly heated you are ready to start the measurement pressing the Start function button.

CAUTION: SOFIA IS ABLE TO GENERATE VERY HIGH VOLTAGES THAT MAY CAUSE YOU SEVERE INJURIES; PAY ATTENTION TO THE RED HAZARD LED; WHEN THE HAZARD LED IS LIT DO NOT TOUCH THE INSTRUMENT.

A complete measurement usually takes several seconds; should you have any doubt and want to stop it press <ESC>: the measurement is immediately stopped.

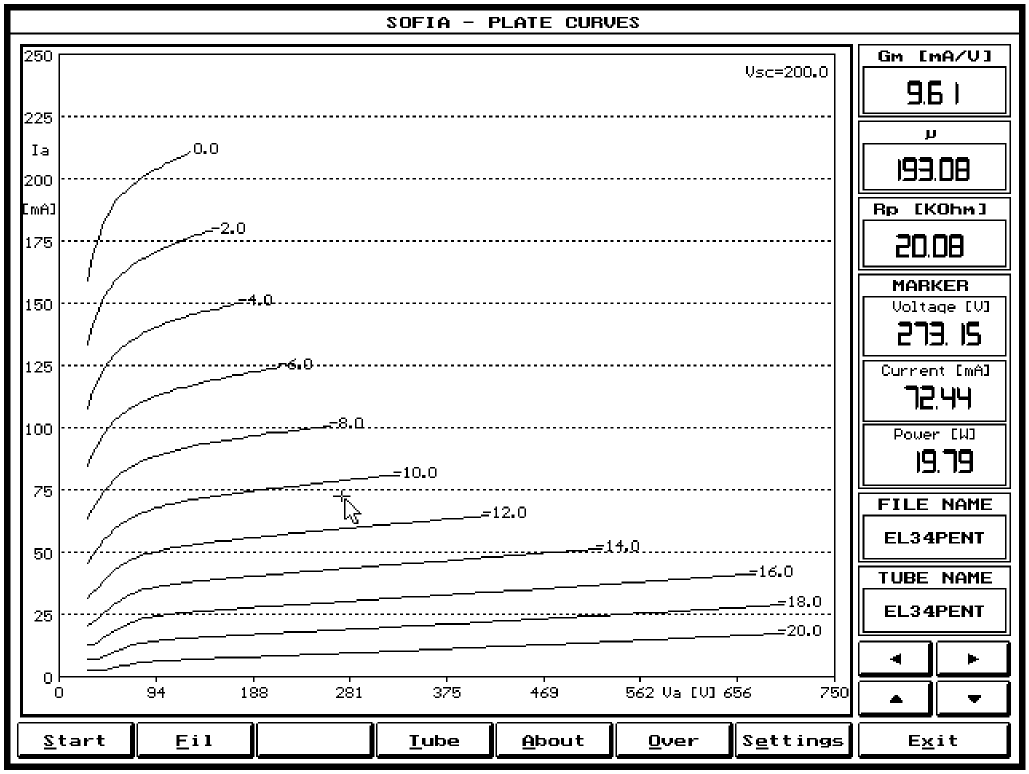


FIGURE 8.6 – EL34 measurement

If everything has gone ok you should be finally prompted with the awaited result as in Fig.8.6.

The arrow keys and the cursor (that can be dragged keeping the left mouse button pressed) help you inspecting the measurement (refer to 8.2.2).

If you want to save it press F2 and if you want to print it press Alt-P.

8.4 MEASURING MODES

Follows a brief description of hardware related arguments in order to better understand how Sofia is behaving in different situations; the next paragraph (8.5) gives a detailed description of the connections involved.

8.4.1 NORMAL

This is the most common Sofia's operating mode. When in normal mode the four voltage generators operate independently; the software assumes that the proper tube terminal is connected to its corresponding voltage generator; let's see a typical connection of a triode (section one of a 6DJ8 twin triode):

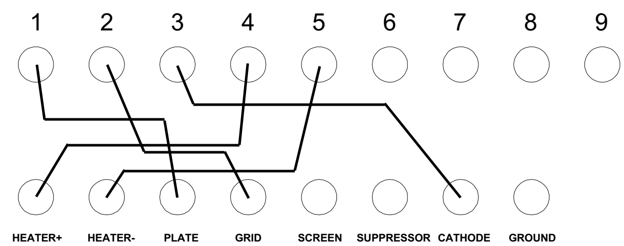


FIGURE 8.5 – Typical connections in normal mode

8.4.2 DUAL

When the Dual operating mode is activated (see 8.2.1) Sofia thinks that a tube with two identical sections is connected and operates in a way that permits the simultaneous measurement of the two sections.

Dual mode is particularly useful when you have to measure common twin triodes and full-wave rectifiers.

To measure both sections simultaneously Sofia uses the Screen voltage generator for the plate of the second section and, in case of triodes, drives both grids together (you have to use the splitting cord when connecting); the cathode of the second section is connected to the Suppressor (or Ground) terminal; let's see how to connect a 6DJ8 twin triode to measure both sections together (note the use of the splitting cord between the Grid and terminal 7):

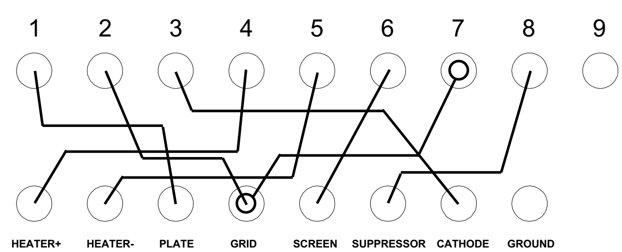


FIGURE 8.5 – Connection of a twin triode in dual mode

NOTE: After the measurement is completed both families of curves are displayed together and the Overlay mode is activated.

NOTE: When saving files in Dual mode the program creates two data files with extension ".PT1" and ".PT2". The files can be recalled later separately as a common ".PTE" file generated when saving in normal mode.

8.4.3 PSEUDO-TRIODE

The Pseudo-Triode is a special measuring mode for pentodes and tetrodes; it is selected from within the Tube Data dialog (see 8.2.2) box and is saved with the corresponding Tube Data file.

The tube is connected as in normal mode but Sofia drives the Plate and Screen generators at the same voltage thus nulling the effect of the second grid.

Fig.8.6 shows the same EL34 pentode of the example described in paragraph 8.3 measured in Pseudo-Triode configuration.

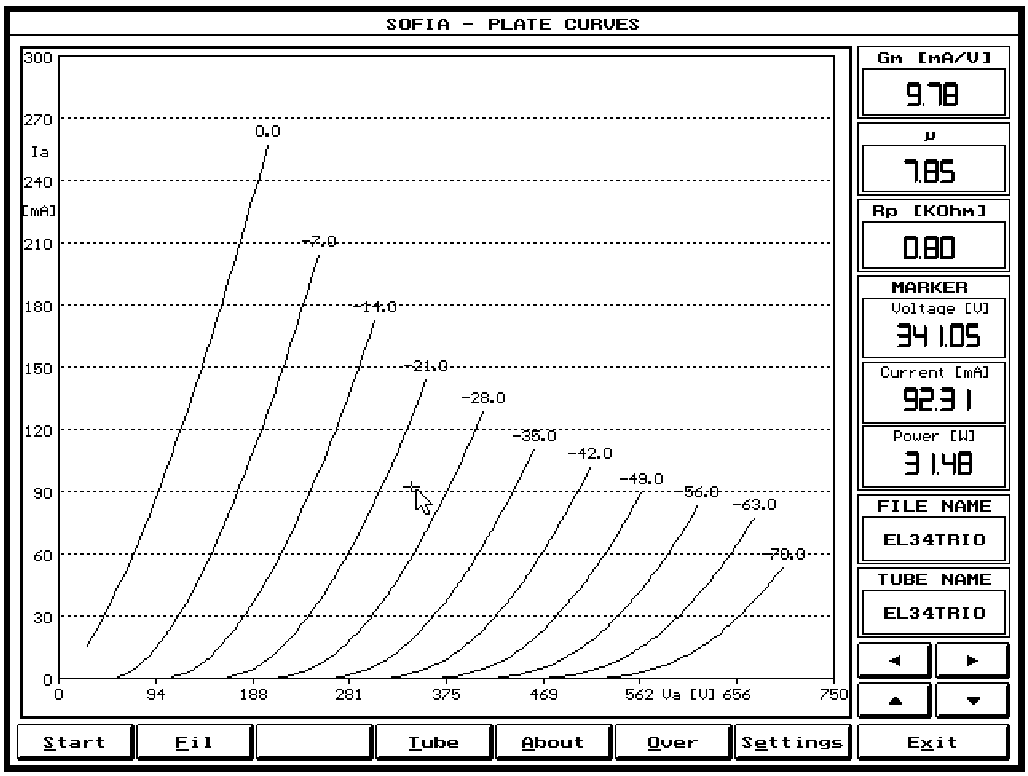


FIGURE 8.6 – EL34 measurement in pseudo-triode

8.4.2 ULTRA-LINEAR

The Ultra-Linear is a special measuring mode for pentodes and tetrodes; it is selected from within the Tube Data dialog (see 8.2.2) box and is saved in the corresponding Tube Data file.

The tube is connected as in normal mode but Sofia drives the Screen generator with a variation in respect of the quiescent Vgs voltage that is a percentage of the variation of plate voltage in respect of the quiescent plate voltage Va0.

The Ultra-Linear percentage is defined in the Ultra[%] field while the quiescent plate voltage is defined in the Va0[V] field in the Tube Data dialog box; both parameters are saved in the corresponding Tube Data file.

Fig.8.7 shows the same EL34 pentode of the example described in paragraph 8.3 measured in Ultra-Linear configuration.

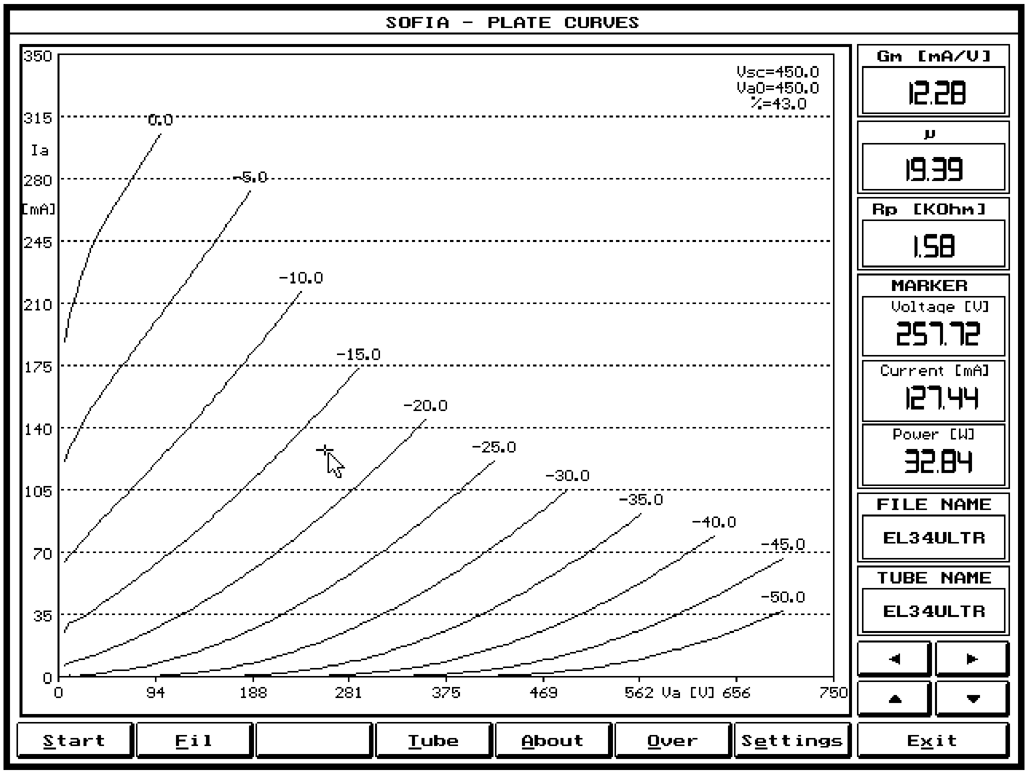


FIGURE 8.6 – EL34 measurement in ultra-linear

8.5 CONNECTIONS

Follows a description of the connections to be manually done when measuring the most common kind of tubes (also specified are the different measuring modes).

ADVICE: use matching color cords when connecting, i.e. insert the red banana plug for plate connection in matching red terminal and so on; this will help you identifying one cord when handling its free end.

NOTE: it is sometimes useful to twist the Grid and the Cathode cords together; this has the desired effect of increasing coupling and, when measuring certain tubes, prevents Sofia to show undesired behaviours.

8.5.1 DIODES

HEATER+	⇨	○	*filament terminal 1*
HEATER-	⇨	○	*filament terminal 2*
PLATE	⇨	○	*plate terminal*
CATHODE	⇨	○	*cathode terminal (no if directly heated)*

And when in Dual mode:

HEATER+	⇨	○	*filament terminal 1*
HEATER-	⇨	○	*filament terminal 2*
PLATE	⇨	○	*plate1 terminal*
SCREEN	⇨	○	*plate2 terminal*
CATHODE	⇨	○	*cathode terminal (no if directly heated)*

8.5.2 TRIODES

HEATER+	⇨	O	*filament terminal 1*
HEATER-	⇨	O	*filament terminal 2*
PLATE	⇨	O	*plate terminal*
GRID	⇨	O	*grid terminal*
CATHODE	⇨	O	*cathode terminal (no if directly heated)*

And when in Dual mode:

HEATER+	⇨	O	*filament terminal 1*
HEATER-	⇨	O	*filament terminal 2*
PLATE	⇨	O	*plate1 terminal*
SCREEN	⇨	O	*plate2 terminal*
GRID	⇨	O	*grid1 terminal*
GRID	⇨	O	*grid2 terminal (with splitting cord)*
CATHODE	⇨	O	*cathode terminal (no if directly heated)*

8.5.3 TETRODES AND PENTODES

HEATER+	⇨	O	*filament terminal 1*
HEATER-	⇨	O	*filament terminal 2*
PLATE	⇨	O	*plate terminal*
GRID	⇨	O	*grid terminal*
SCREEN	⇨	O	*screen terminal*
SUPPRESSOR	⇨	O	*suppressor terminal (only pentodes)*
CATHODE	⇨	O	*cathode terminal (no if directly heated)*

8.6 MEASURE QC CONTROL PANEL

With this control panel Sofia performs quality control over large production batches by means of a file-driven measurement session; all the tests performed are described in the pre-loaded ".QC" setup file (see 8.6.2).

Fig. 8.1 shows the layout of the Measure Plate control panel.

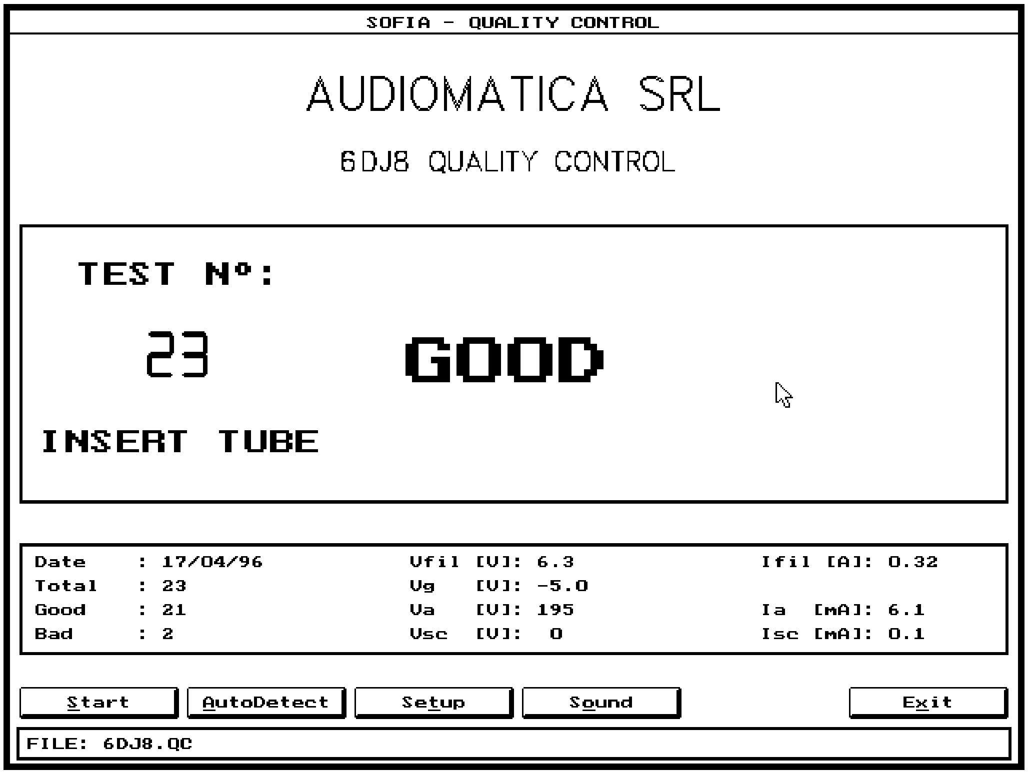


FIGURE 8.7 – The Measure QC control panel

NOTE: When saving or loading files from disk in this control panel, always remember that the file extension connected to this measurement is ".QC". This extension will be used automatically when you are working from within the Measure QC control panel.

8.6.2 FUNCTION BUTTONS

Start — Starts a new tube measurement.

Autodetect — Selects the autodetect mode. In this operating mode Sofia senses the presence of a tube and automatically starts a new measurement whenever the tube is inserted in the socket.

Se**t**up — Recalls a new QC setup file. See 8.6.2

S**o**und — When active the measurement is guided with sounds signaling the start, end and "waiting for a tube" situations.

E**x**it — Exits the Measure QC control panel.

8.6.2 OPERATING WITH THE QC CONTROL PANEL

When operating with this Sofia's control panel you need, first of all, to load a setup file (the first time you are prompted to choose one); then you have to make the usual connections for the particular tube under test; at this point you are ready to start a QC session.

CAUTION: SOFIA IS ABLE TO GENERATE VERY HIGH VOLTAGES THAT MAY CAUSE YOU SEVERE INJURIES; PAY ATTENTION TO THE RED HAZARD LED; WHEN THE HAZARD LED IS LIT DO NOT TOUCH THE INSTRUMENT.

When you are debugging a QC setup file you may want to access the Tube Data dialog box and the Main control panel that are directly recallable from within the QC control panel with F1 and F4.

After having started the measurement Sofia displays the "HEATING" message and wait for the time in seconds given with the appropriate file command; after this time the measurements at the defined measurements points are performed; the results are displayed in real-time.

If all the measurements selected are within the specified limits the "GOOD" message appears, otherwise "BAD" appears.

All the measurement session counters are then updated and automatically saved in the QC session report file (see 8.6.4).

8.6.3 THE QC SETUP FILE

This file is a plain ASCII file that describes what tests will be done during the measurement session; it can be easily created with any text-editor; pay great attention to its particular syntax. Follows the sample file contained in the distribution disk that serves as an example for creating others.

\DATA\JOB1\6DJ8.QC file:

```
;THIS IS A SAMPLE QUALITY CONTROL SETUP FILE ('.QC' EXTENSION)

COMPANY=AUDIOMATICA SRL

TITLE=6DJ8 Quality Control

VFIL=6.3           ; [Volts]

IFIL=0.33          ; [Amperes]
IFTOL=10           ; [%]

AUTODETECT=0       ; 0=off 1=on
HEATINGDELAY=1     ; [s]

[DATA]
VGRID[V]  VANODE[V]  IANODE[mA]  IATOL(%)  VSCREEN(V)  ISCREEN(mA)  ISTOL(%)
-4        190        14          20        0           0            0
-5        195        7           20        0           0            0
```

The following syntax has to be strictly used:

; (semicolon)   Begins a comment line.

COMPANY First of the two title lines.

TITLE Second of the two title lines.

VFIL Heater voltage to be set in volts.

IFIL Heater current to be measured in amperes; if zero no measurement takes place.

IFTOL Heater current tolerance [%].

AUTODETECT Turns the autodetect mode on (if=1) or off (if=0).

HEATINGDELAY Delay time needed to warm-up the tube in seconds.

[DATA] Initiates a declaration part where it is defined a table of measuring points; each point is defined with the grid, plate and screen voltages (in volts) that has to be set and with the anode and screen currents (in milliamperes) that has to be measured with respective tolerances [%]; if any current is defined as zero the measurement doesn't take place.

8.6.4 THE QC SESSION REPORT FILE

The QC session report file is automatically generated to help the user track a QC work session. This file has a ".REP" extension and is structured in the following three parts:

- A header reporting the date and the QC setup measurement data.

- A body reporting all the measurements done. The difference, in percentage, with the setup data is displayed and when it is out of tolerance limits "BAD" indicates that the measurement was not passed.

- A footer reporting the total number of tubes tested with statistics regarding good a bad ones.

\DATA\JOB1\6DJ8.REP file:

```
DATE: 22/04/96
VF[V]     IF[A]     IFT[%]
6.3       0.33      20
VG[V]     VA[V]     IA[mA]    IAT[%]
-4        190       14        20
-5        195       7         20
TUBE No 1
VF[V]     IF[A]     IFT[%]
6.3       0.38      +15
VG[V]     VA[V]     IA[mA]    IAT[%]
-4        190       12        -15
-5        195       8.1       +16
TUBE No 2
VF[V]     IF[A]     IFT[%]
6.3       0.32      -3
VG[V]     VA[V]     IA[mA]    IAT[%]
-4        190       10.5      -25   BAD
-5        195       4.3       -39   BAD
TOTAL     =    2
GOOD      =    1
BAD       =    1
```

9 SOFIA'S MAIN CONTROL PANEL

9.1 INTRODUCTION

The Sofia's main control panel is recallable from within any measurement with the hot key F4 and gives you instant control over the instrument and its functionality.

Figure 9.1 shows this control panel.

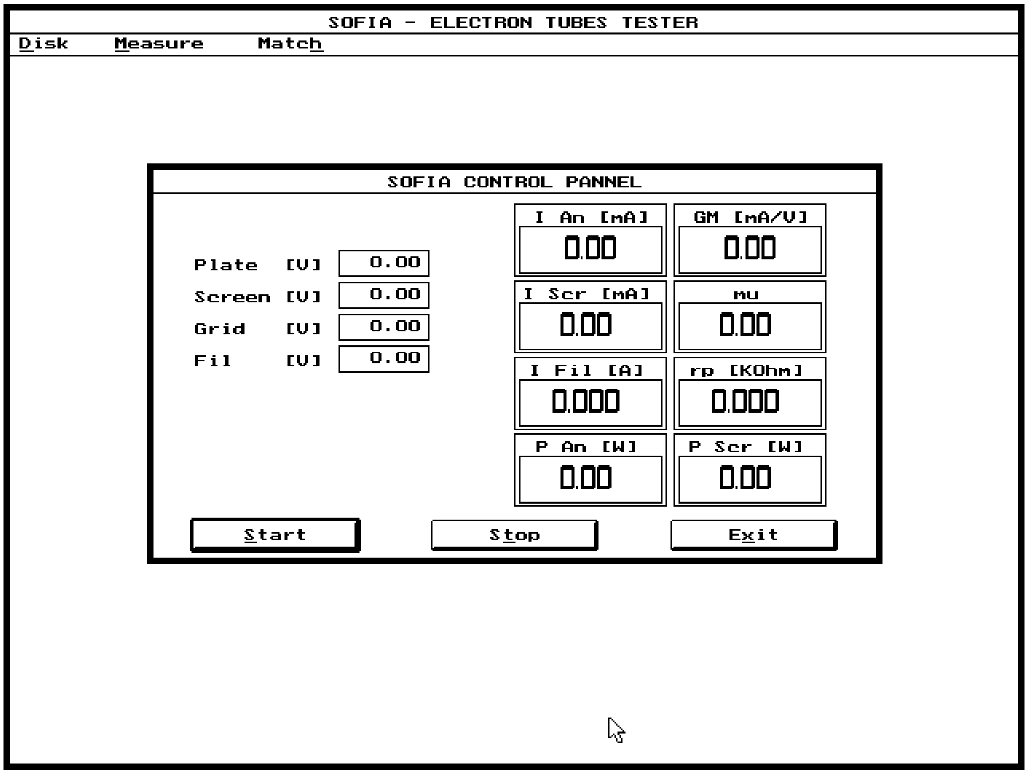


FIGURE 9.1 – Sofia's main control panel

9.2 MAIN CONTROL PANEL OPERATION

It is possible to input the desired voltage values that each single generator has to supply. All the voltages are generated continuously as soon as the Start button is pressed and until the Stop button is pressed.

The panel displays several informations including:

- Filament current
- Anode current
- Anode power dissipation
- Screen current
- Screen power dissipation
- Gm, Rp, μ

10 MATCH MENU

10.1 INTRODUCTION

By selecting the Match command from the main menu bar, it is possible to carry out matching of tubes characteristics measurements.

10.2 MATCH CONTROL PANEL

Fig. 10.1 shows the layout of the Match control panel.

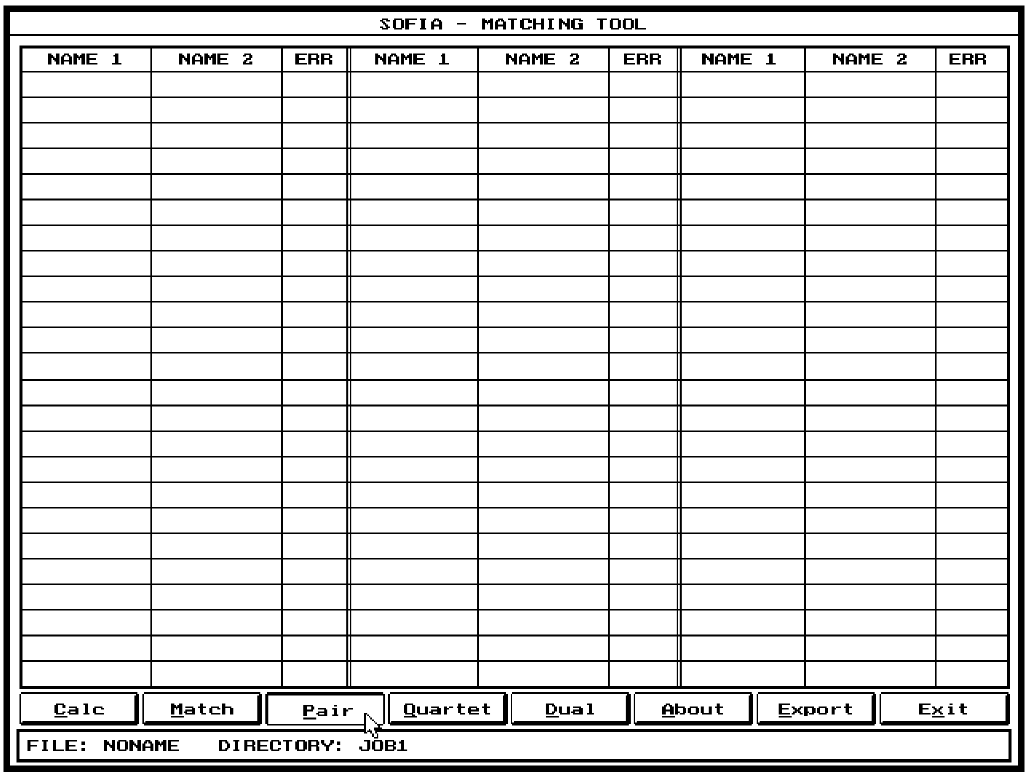


FIGURE 10.1 – The Match control panel

NOTE: When saving or loading files from disk in this control panel, always remember that the file extension connected to this measurement are ".MTC". These extensions will be used automatically when you are working from within the Match control panel.

10.2.1 FUNCTION BUTTONS

Calc Calculates the reciprocal matching factors of all the measurement data files in the working directory. It is always the first thing to do when matching a certain quantity of tube data files; after this operation the files will be matched (using the Match button) following the desired strategy.

Match Finds the best matches and displays them, starting from the best one, in a descending order.

Pair Selects the Pair matching strategy. See 10.3.

Quartet Selects the Quartet matching strategy. See 10.3.

Dual Selects the Dual matching strategy. It is a particular case of the Pair or Quartet strategies when we are dealing with twin tubes measured with the Dual measuring mode. See 10.3.

About Used to insert or display a text comment describing the present measurement. The comment will be saved with the measurement.

Export Used to export the present measurement in ASCII text format.

E**x**it Exits the Match control panel.

10.3 MATCHING STRATEGIES AND SOME EXAMPLES

It has to be clearly understood that the program works, during the matching process, with ALL tube measurement files (".PTE", ".PT1", ".PT2") present in the currently selected working directory.

Lets now assume that we measured sixteen 6550 tubes and that we saved their curves in the files named "TUBE1.PTE", "TUBE2.PTE" and so on until "TUBE16.PTE" and that we are working in their directory named 6550.

As a preliminary one has to perform the calculation of the reciprocal matching factors (with the Calc button); this calculation may take some time, signaled by a progress indicator.

We can then match our tubes either in pairs or in quartets. If you select the Pair matching strategy you get the situation illustrated in Fig.10.2.

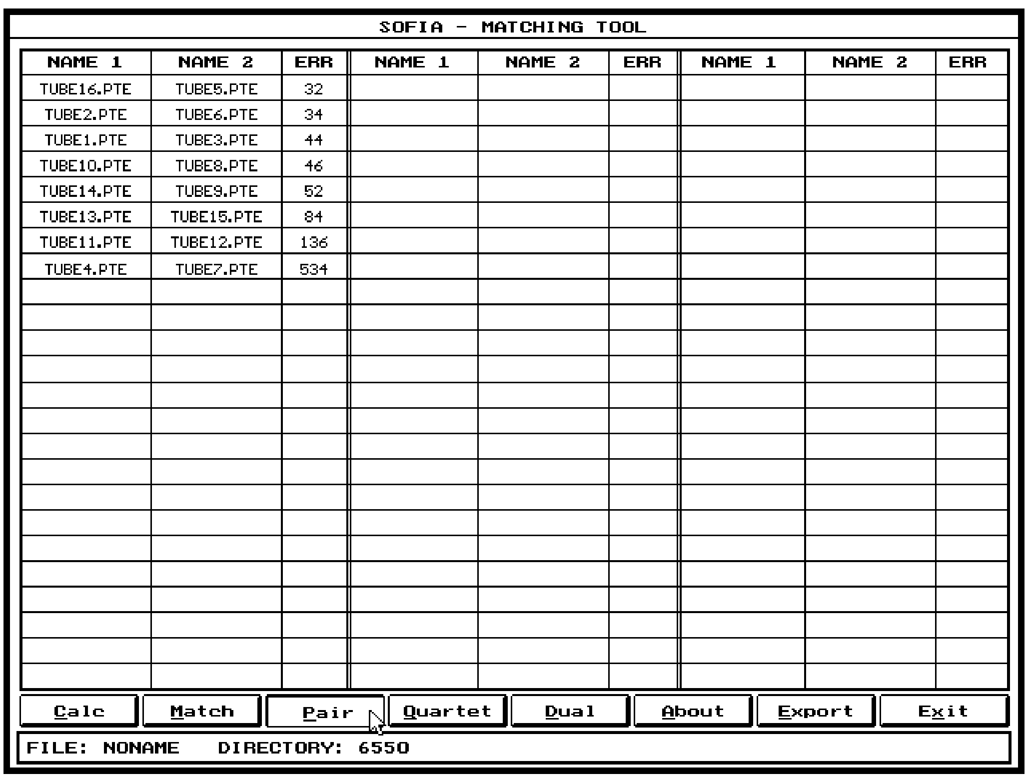


FIGURE 10.2 – The Pair matching strategy

As you can see the software produces a list of couples of tubes ordered by their matching factors, that are displayed nearby; the best couple is listed first and then the others in a descending order. The first couple is the best among all tubes; the second is the best among the remaining tubes when you subtract the first two, and so on.

If you select the Quartet matching strategy you get the situation illustrated in Fig.10.3.

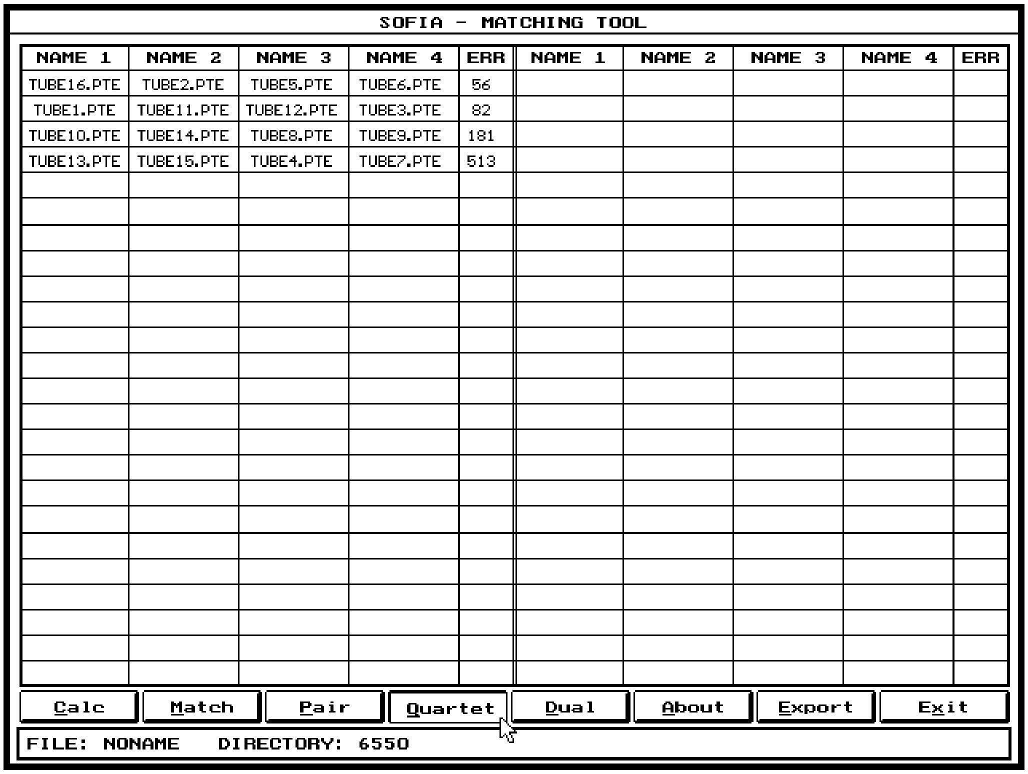


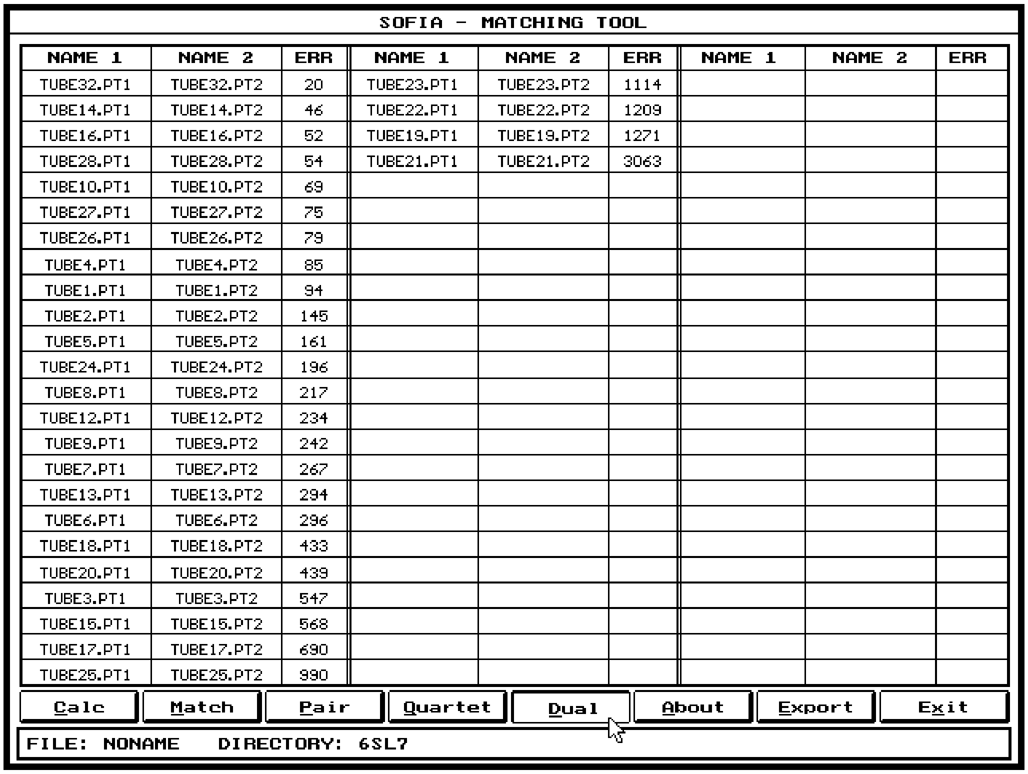
FIGURE 10.3 – The Quartet matching strategy

To explain how Dual affects the aforementioned strategies lets now assume that we measured 32 6SL7 twin triodes and that we saved their curves in the files named "TUBE1.PT1", "TUBE1.PT2", "TUBE2.PT1", "TUBE2.PT2" and so on until "TUBE32.PT1" and "TUBE32.PT2" and that we are working in their directory named 6SL7.

After having calculated the matching factors if you select Dual together with the Pair matching strategy you get the situation illustrated in Fig.10.4.

As you can see the tubes are listed starting from the one that has the two internal sections best matched and reaching the worst one.

If you select Dual with the Quartet matching strategy you can match two twin tubes; the displayed screen will be like the one in Fig.10.3 but the first two curves will belong to one single twin tube and the third and the fourth ones will belong to a second matched twin tube.



SOFIA - MATCHING TOOL

NAME 1	NAME 2	ERR	NAME 1	NAME 2	ERR	NAME 1	NAME 2	ERR
TUBE32.PT1	TUBE32.PT2	20	TUBE23.PT1	TUBE23.PT2	1114			
TUBE14.PT1	TUBE14.PT2	46	TUBE22.PT1	TUBE22.PT2	1209			
TUBE16.PT1	TUBE16.PT2	52	TUBE19.PT1	TUBE19.PT2	1271			
TUBE28.PT1	TUBE28.PT2	54	TUBE21.PT1	TUBE21.PT2	3063			
TUBE10.PT1	TUBE10.PT2	69						
TUBE27.PT1	TUBE27.PT2	75						
TUBE26.PT1	TUBE26.PT2	79						
TUBE4.PT1	TUBE4.PT2	85						
TUBE1.PT1	TUBE1.PT2	94						
TUBE2.PT1	TUBE2.PT2	145						
TUBE5.PT1	TUBE5.PT2	161						
TUBE24.PT1	TUBE24.PT2	196						
TUBE8.PT1	TUBE8.PT2	217						
TUBE12.PT1	TUBE12.PT2	234						
TUBE9.PT1	TUBE9.PT2	242						
TUBE7.PT1	TUBE7.PT2	267						
TUBE13.PT1	TUBE13.PT2	294						
TUBE6.PT1	TUBE6.PT2	296						
TUBE18.PT1	TUBE18.PT2	433						
TUBE20.PT1	TUBE20.PT2	439						
TUBE3.PT1	TUBE3.PT2	547						
TUBE15.PT1	TUBE15.PT2	568						
TUBE17.PT1	TUBE17.PT2	690						
TUBE25.PT1	TUBE25.PT2	990						

Calc | Match | Pair | Quartet | Dual | About | Export | Exit

FILE: NONAME DIRECTORY: 6SL7

FIGURE 10.4 – The Dual option with Pair matching strategy



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SOFIA FEATURES - HARDWARE

HOW DOES HARDWARE DESIGN REFLECT ON YOUR INSTRUMENT ?

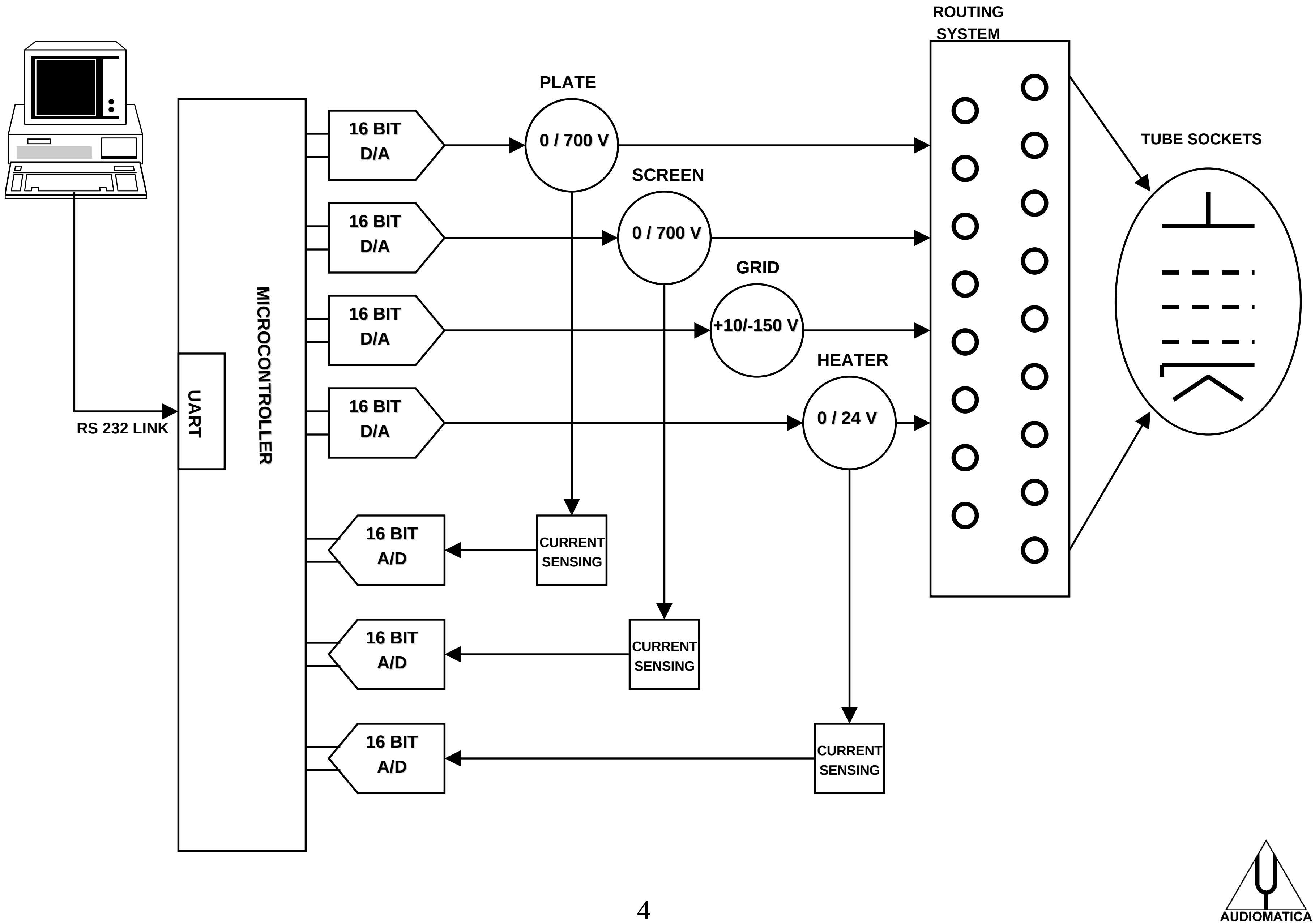
- GENERAL PERFORMANCE AND ACCURACY
- EASY POSSIBILITY OF TUBE CONNECTION
- TWO SEPARATE HIGH VOLTAGE GENERATOR
- TRIODE, PENTODE, ULTRA LINEAR SUPPORTED
- STANDARD RS 232 CONNECTION TO IBM-PC

AUDIOMATICA

SOFIA FEATURES - SOFTWARE

HOW DOES SOFTWARE DESIGN REFLECT ON YOUR INSTRUMENT ?

- IT'S EASY TO LEARN
- IT'S EASY TO USE IN EVERYDAY WORK
- GIVES YOU THE IMPRESSION OF FACING AND OPERATING A REAL INSTRUMENT
- GIVES YOU FULL DATA STORAGE CAPABILITY
- GIVES YOU A PREDEFINED, USER EXTENDABLE TUBE LIBRARY



ROUTING SYSTEM
PLATE
0 / 700 V
SCREEN
0 / 700 V
GRID
+10/-150 V
HEATER
0 / 24 V
TUBE SOCKETS
16 BIT D/A
16 BIT D/A
16 BIT D/A
16 BIT D/A
MICROCONTROLLER
UART
RS 232 LINK
16 BIT A/D
16 BIT A/D
16 BIT A/D
CURRENT SENSING
CURRENT SENSING
CURRENT SENSING
AUDIOMATICA

SOFIA SOFTWARE CAPABILITIES

• PLATE CHARACTERISTICS MEASUREMENT

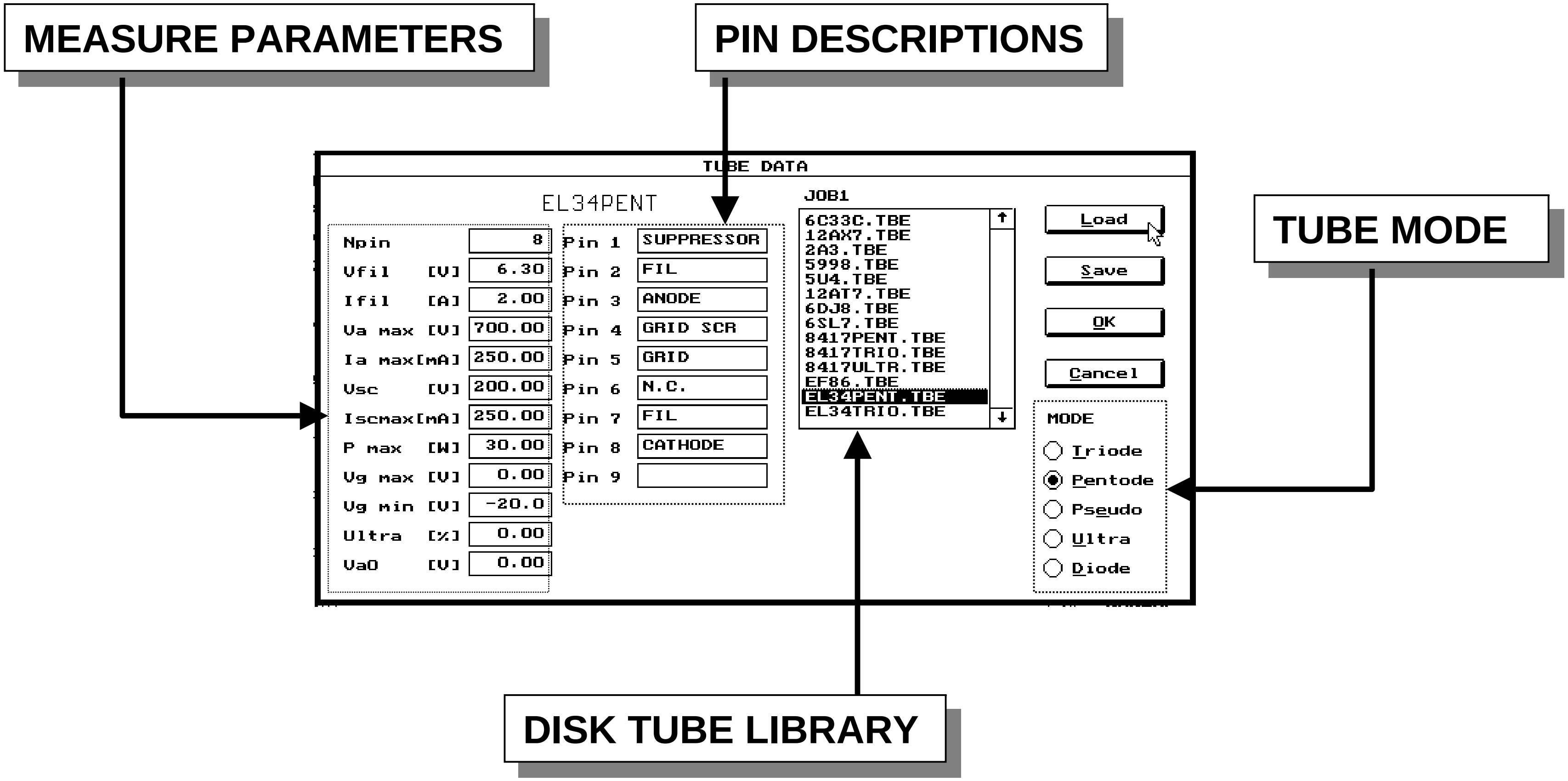
• STATIC USER DEFINABLE, PROGRAMMABLE CONTROL PANEL WITH TRANSCODUCTANCE PLATE RESISTANCE AND MU

• FILE DRIVEN QC TESTS PROCEDURES

• BEST MATCH BETWEEN BATCH OF TUBES

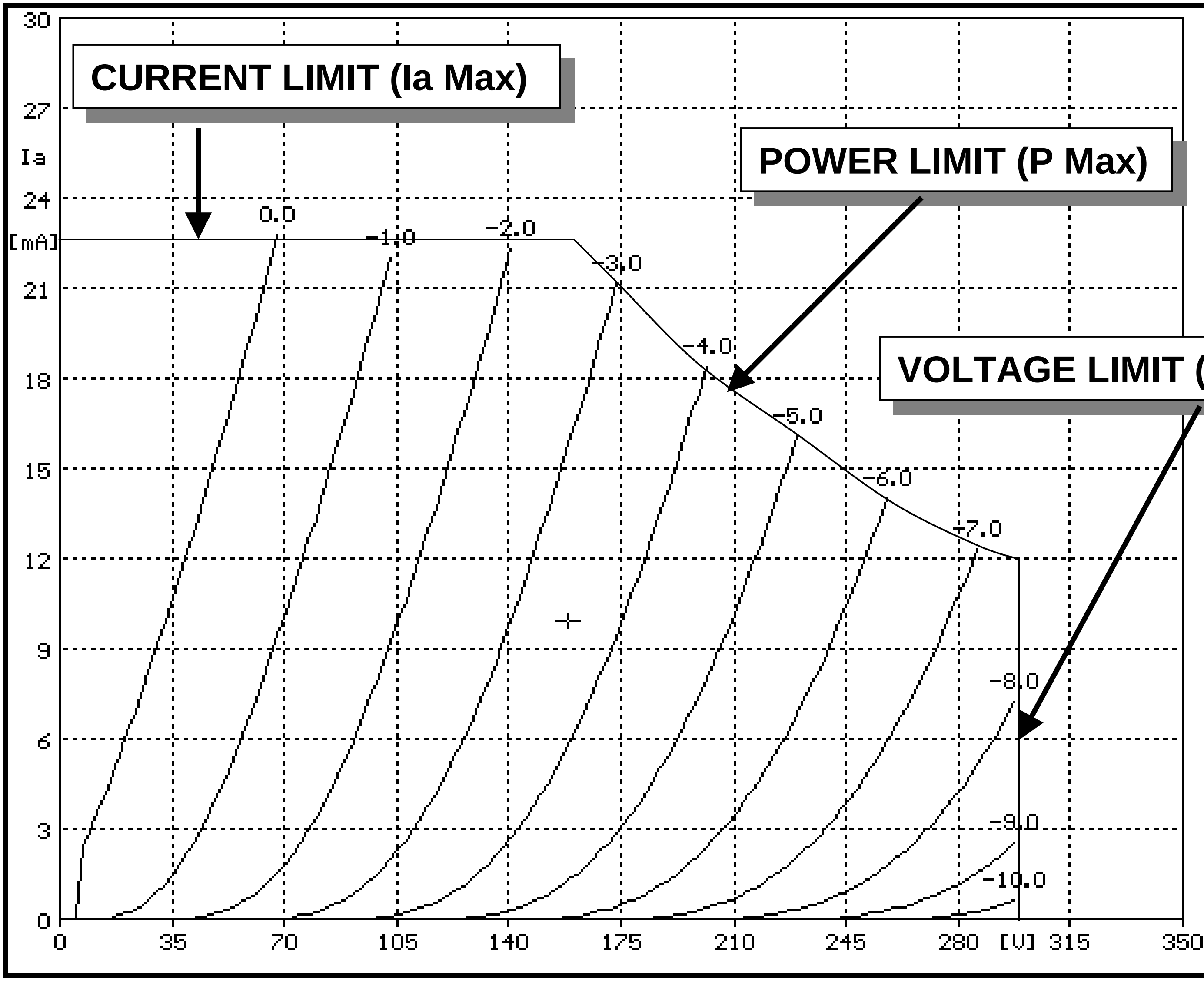
AUDIOMATICA

SOFIA TUBE SETTINGS PANEL



AUDIOMATICA

SOFIA TUBE SETTINGS LIMITS



AUDIOMATICA

LIMITS WITH SCREEN GRID

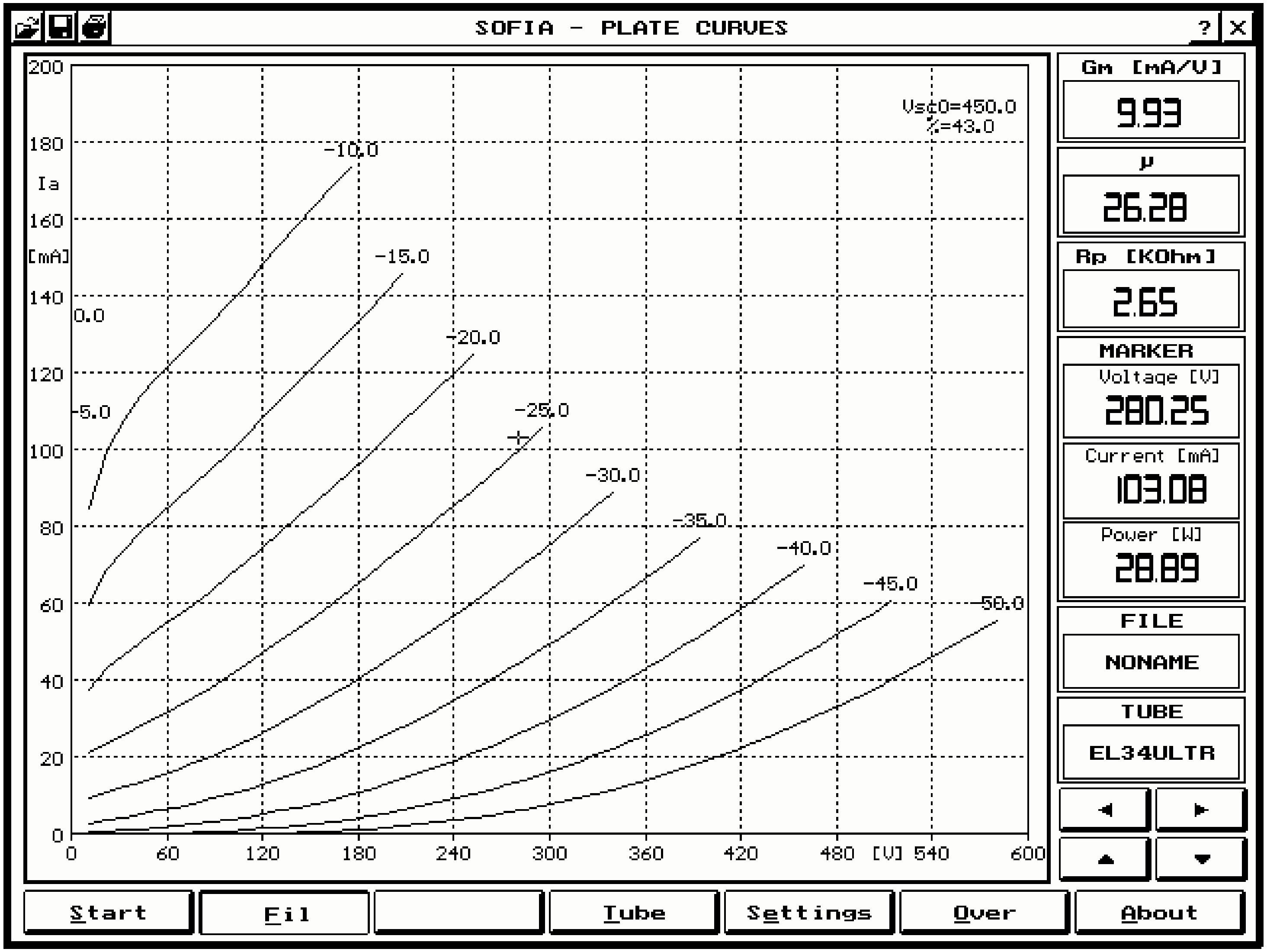
BOTH Iamax AND Iscmax ARE EVALUATED

THE FIRST ONE REACHED IS USED

Pmax IS THE SUM OF ANODE AND SCEEN DISSIPATION

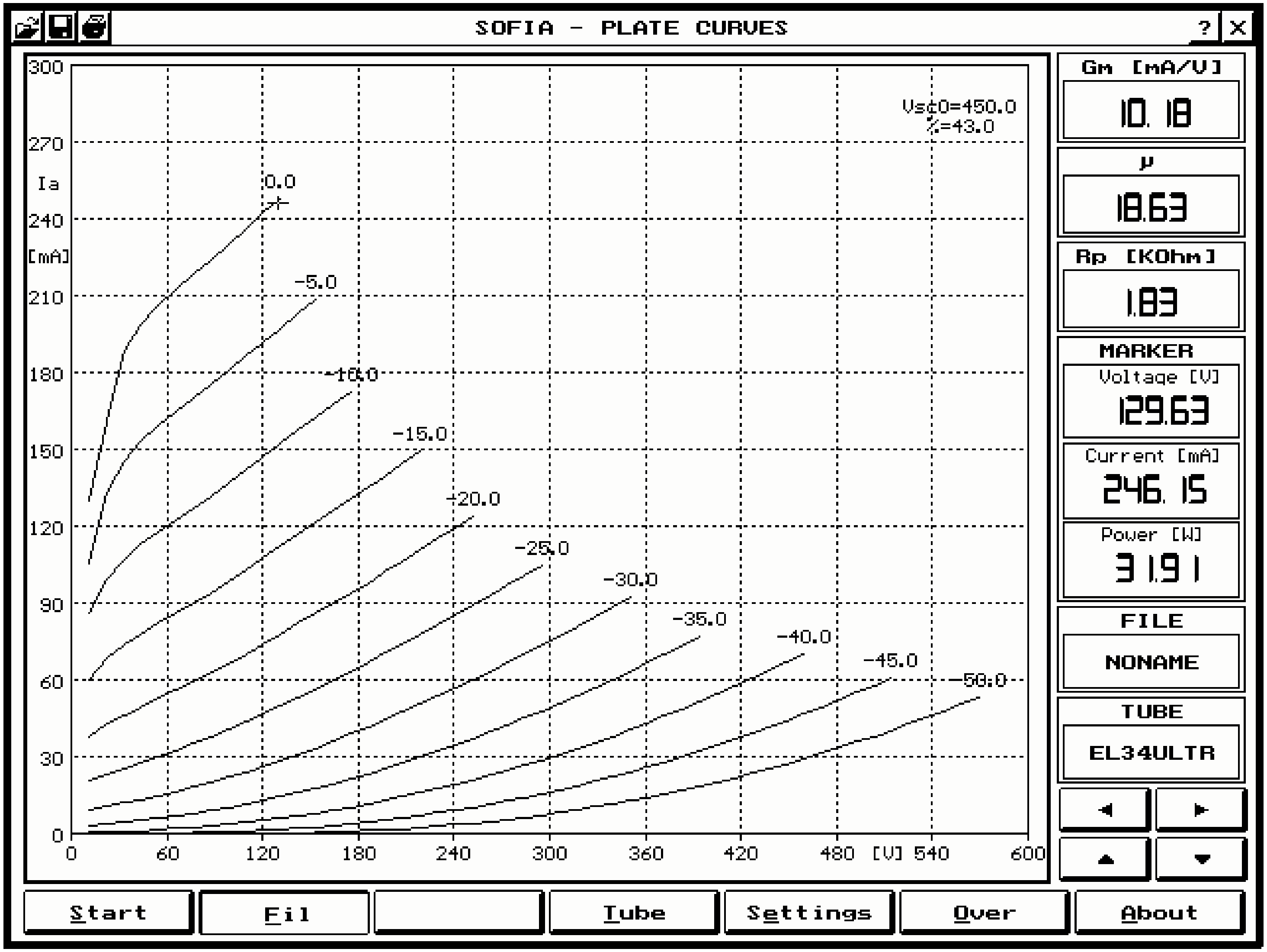
USUALLY FOR ULTRALINEAR AND PSEUDOTRIODE MODE CURVES, TUBE MANUFACTURERS SCREEN CURRENT HAS TO BE EXCEEDED

6L6GC ULTRA-LINEAR 40mA Iscmax



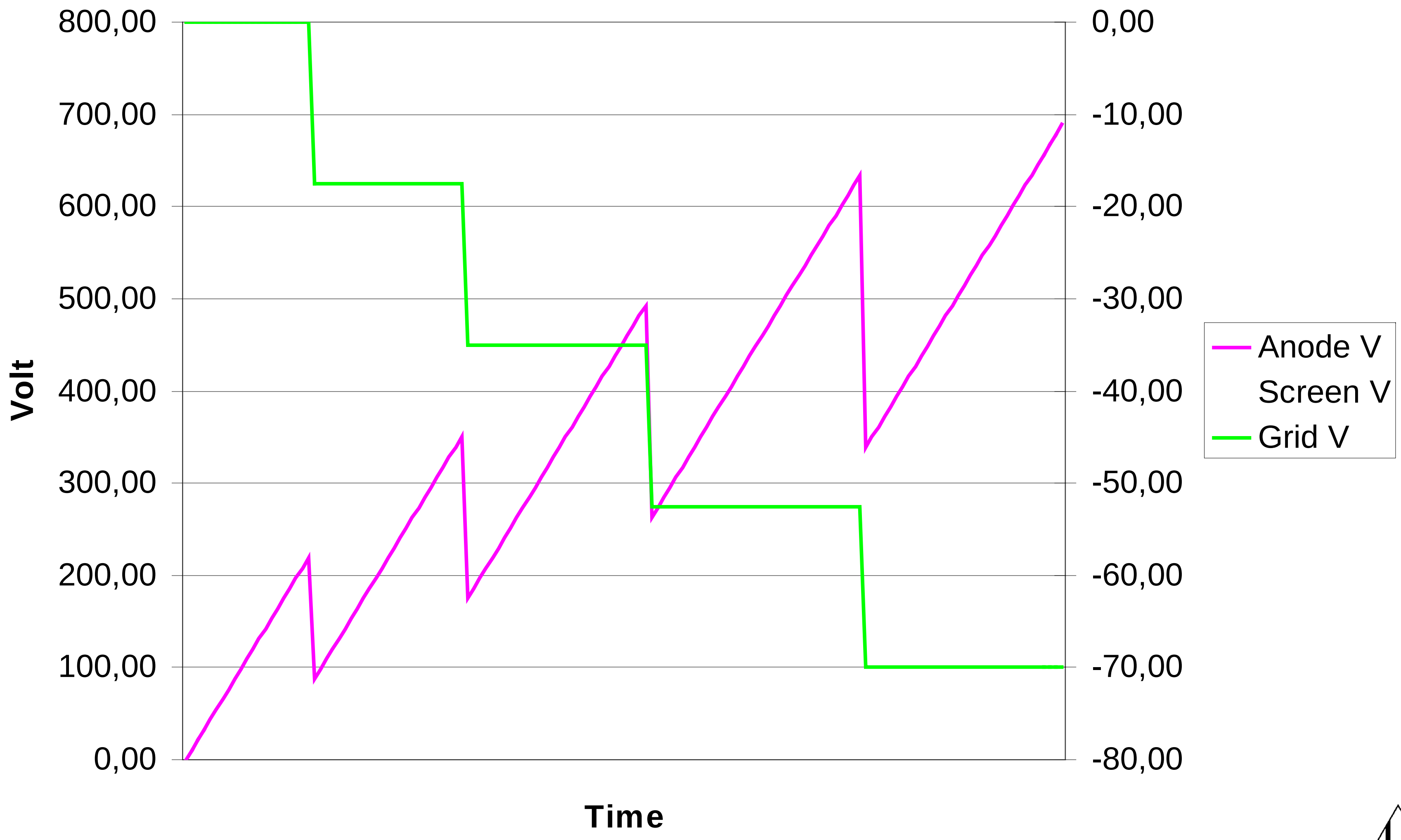
AUDIOMATICA

6L6GC ULTRA-LINEAR 100mA Iscmax



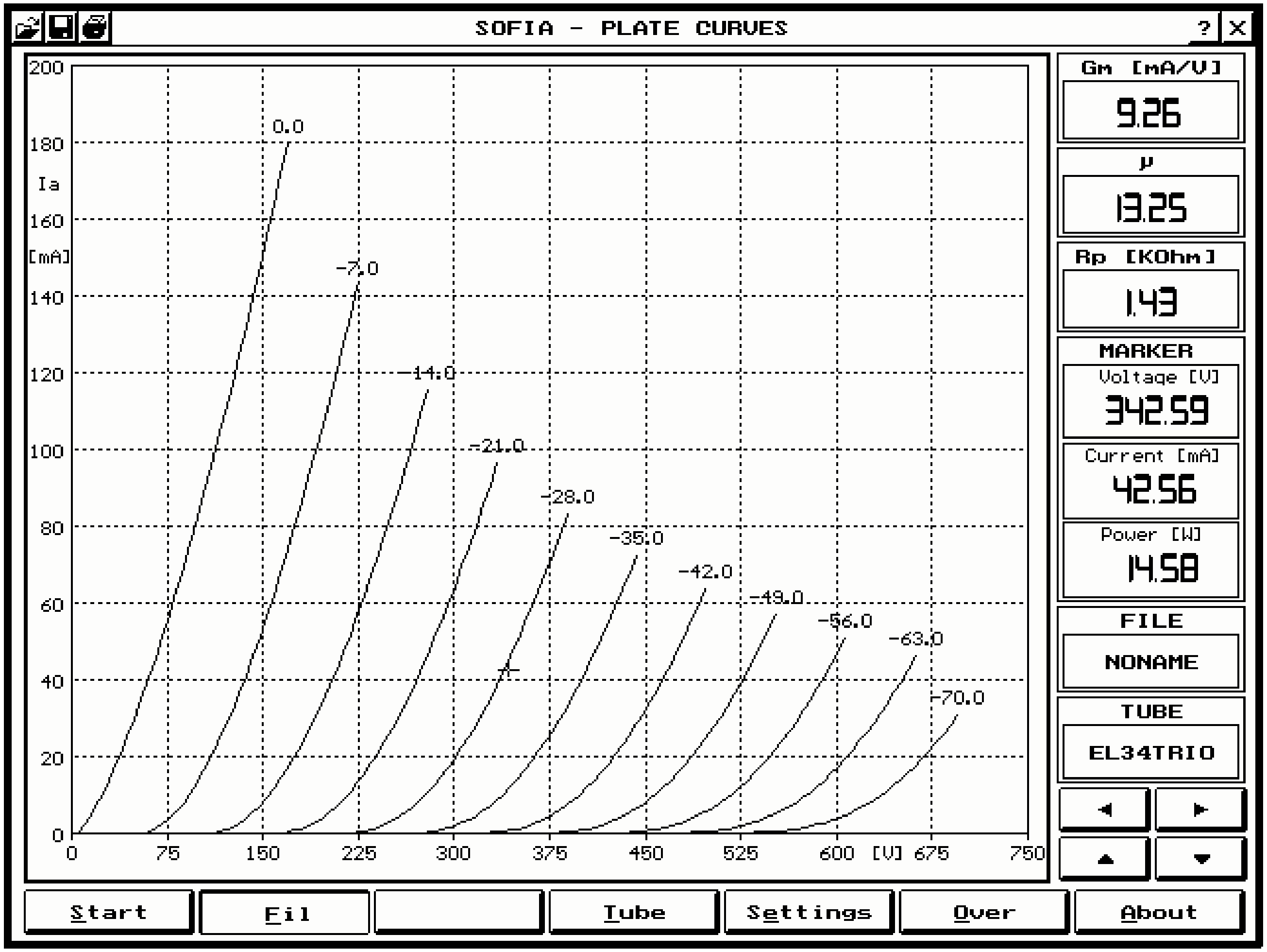
AUDIOMATICA

SOFIA VOLTAGES Vs. TIME TRIODE



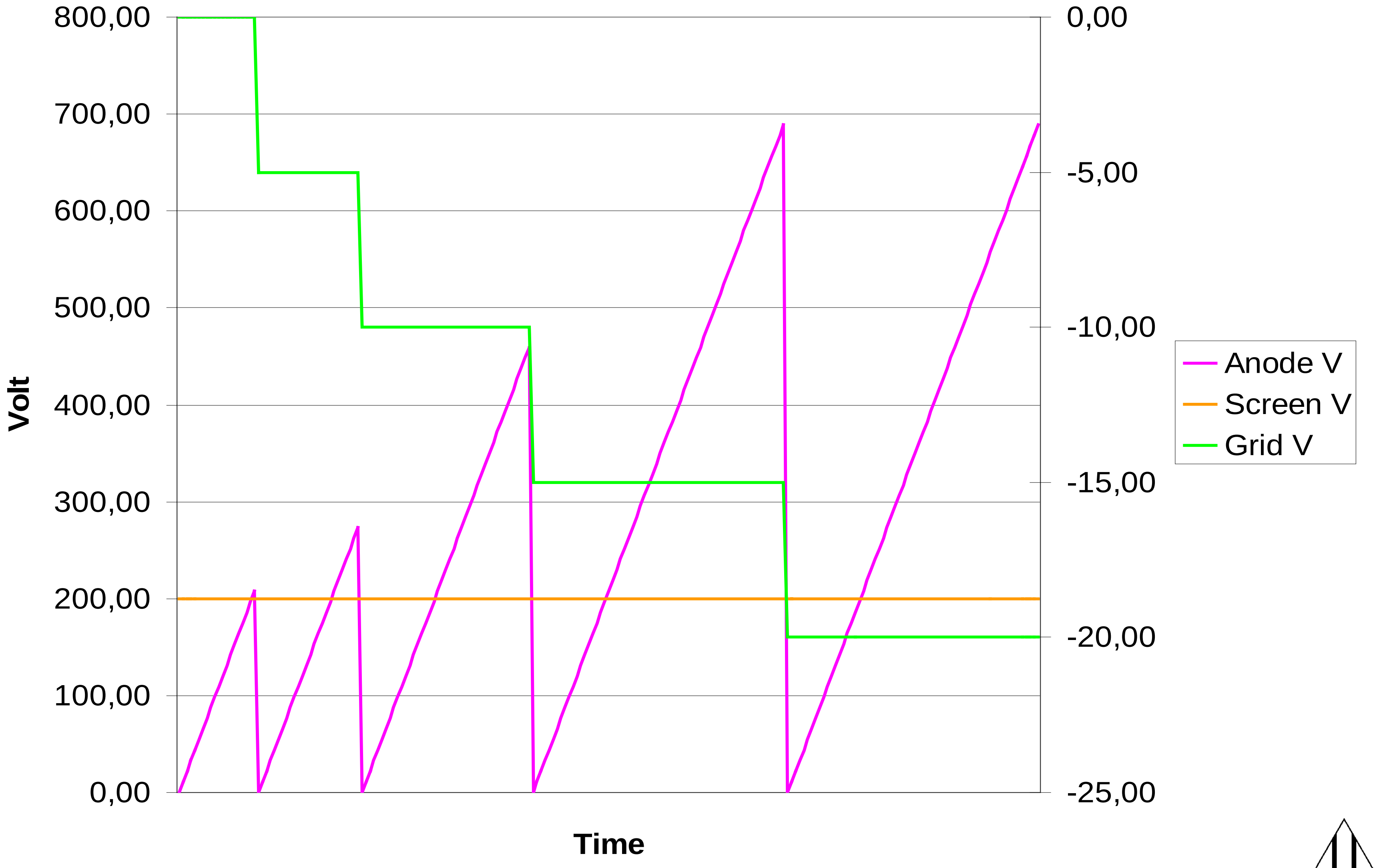
AUDIOMATICA

SOFIA - EL 34 PSEUDO-TRIODE MODE



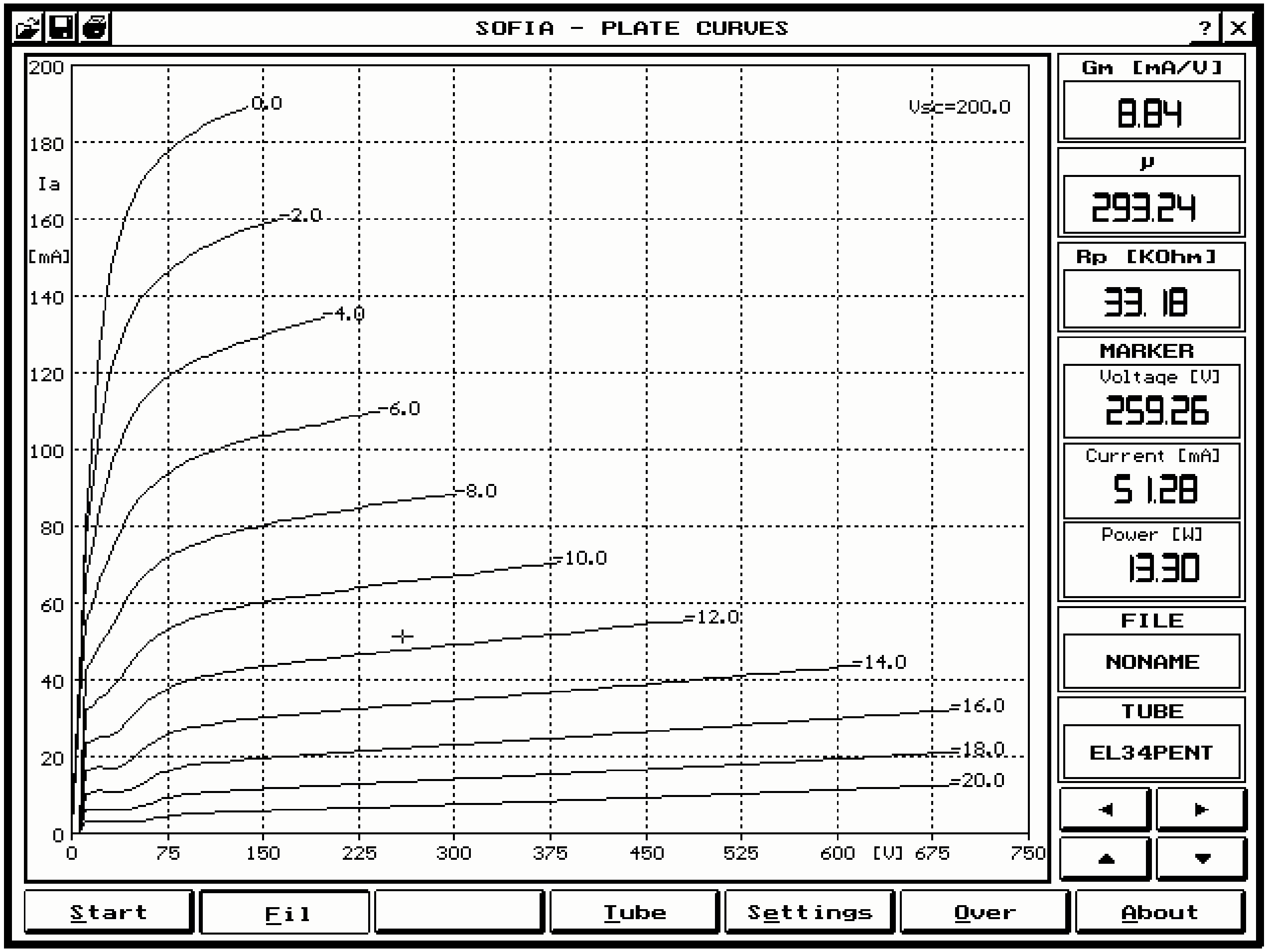
AUDIOMATICA

SOFIA VOLTAGES Vs. TIME PENTODE

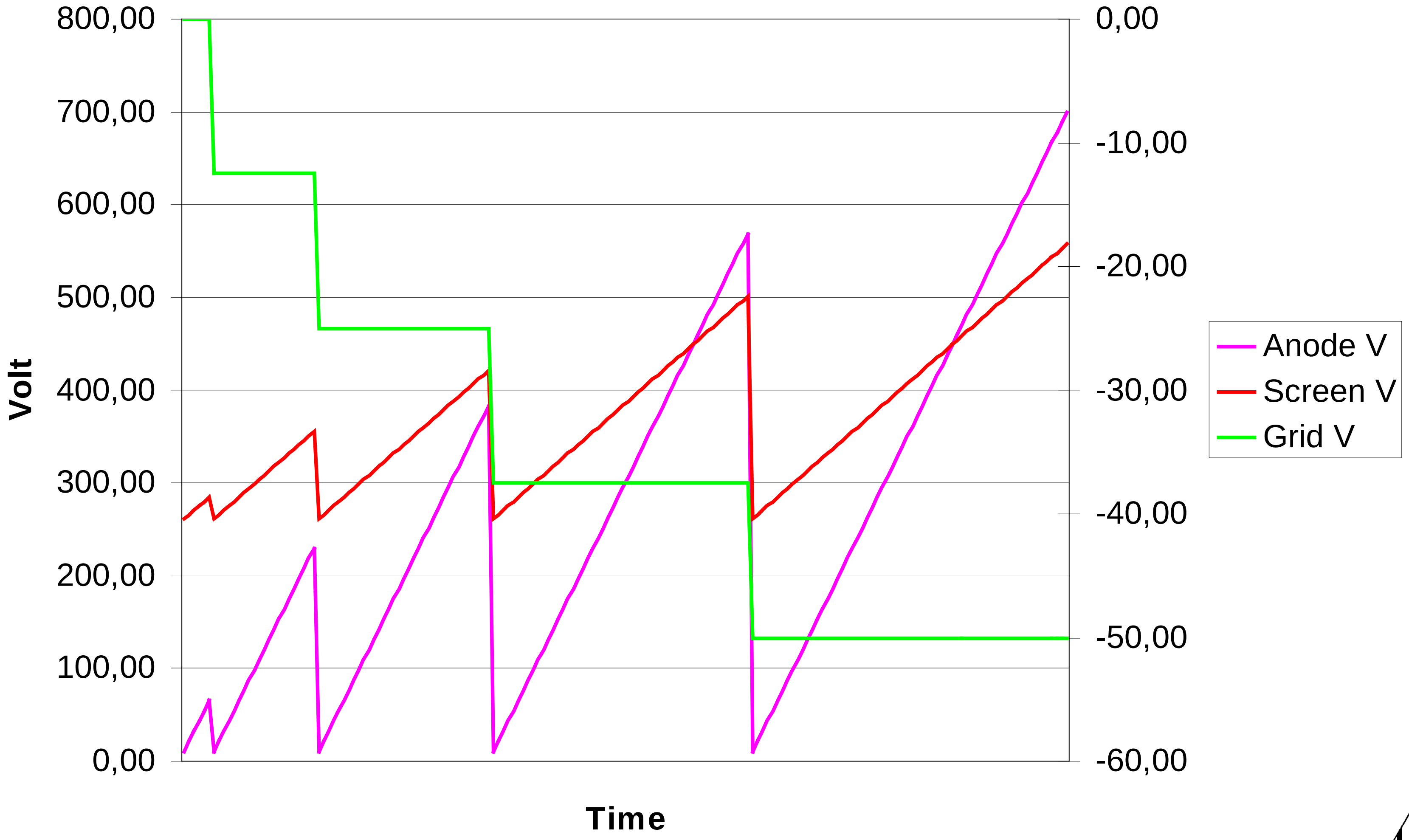


AUDIOMATICA

SOFIA - EL 34 PENTODE MODE

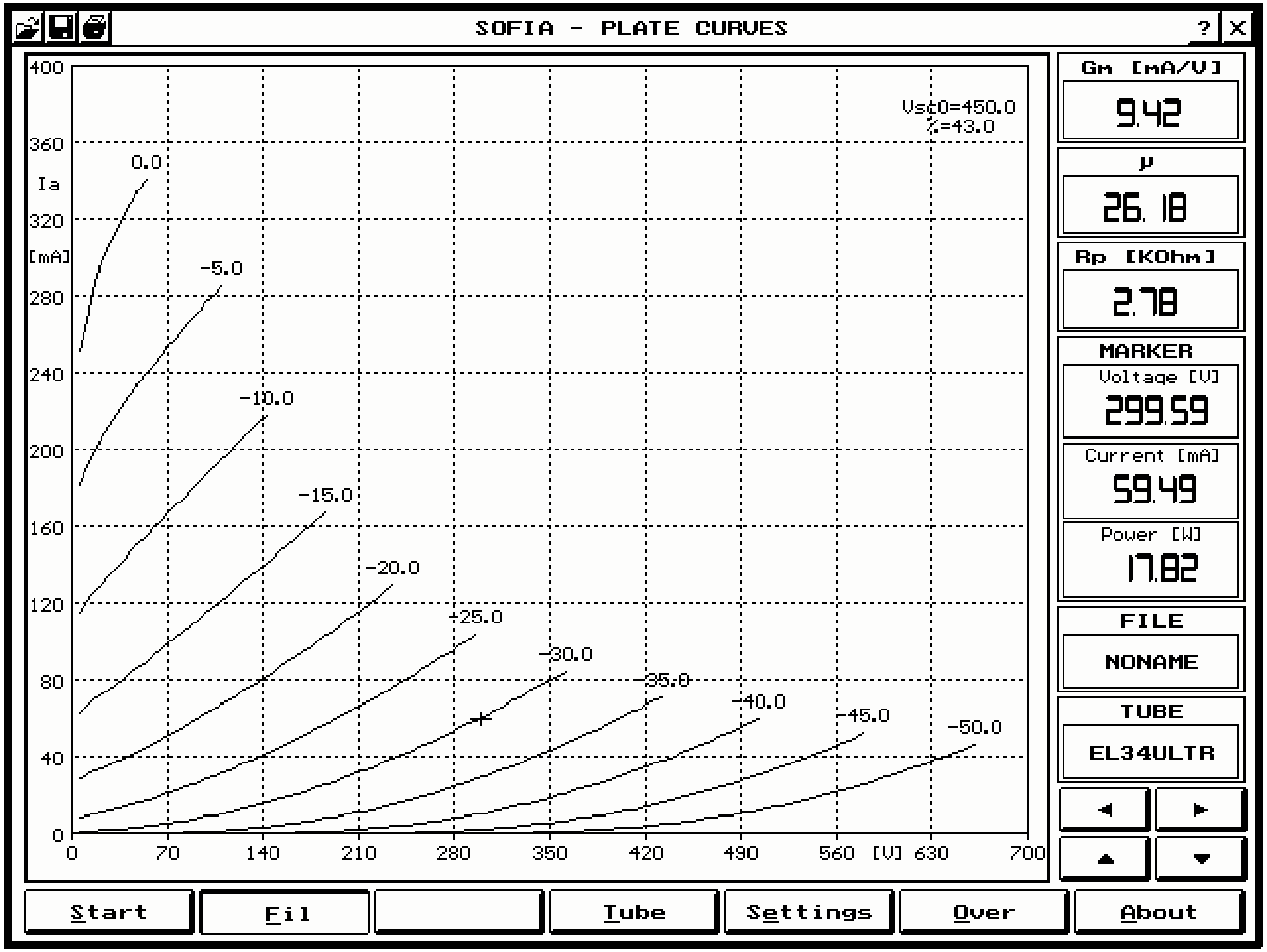


SOFIA VOLTAGES Vs. TIME ULTRA (43%, 450V)



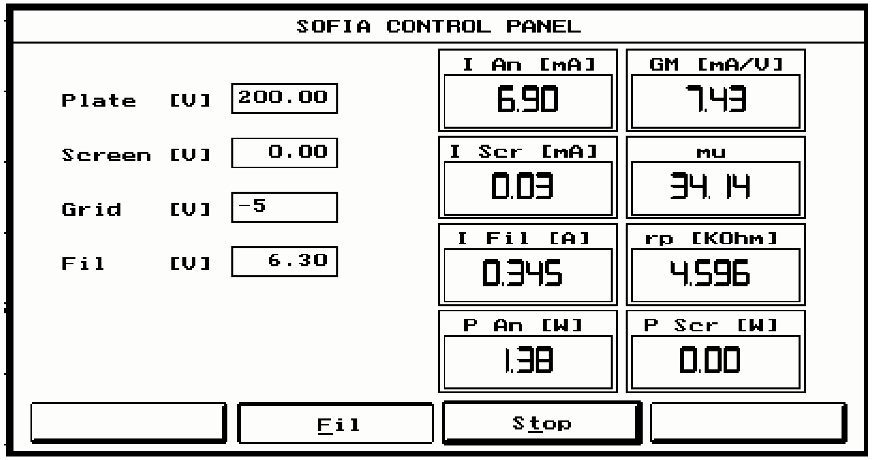
AUDIOMATICA

SOFIA - EL 34 ULTRA-LINEAR MODE



AUDIOMATICA

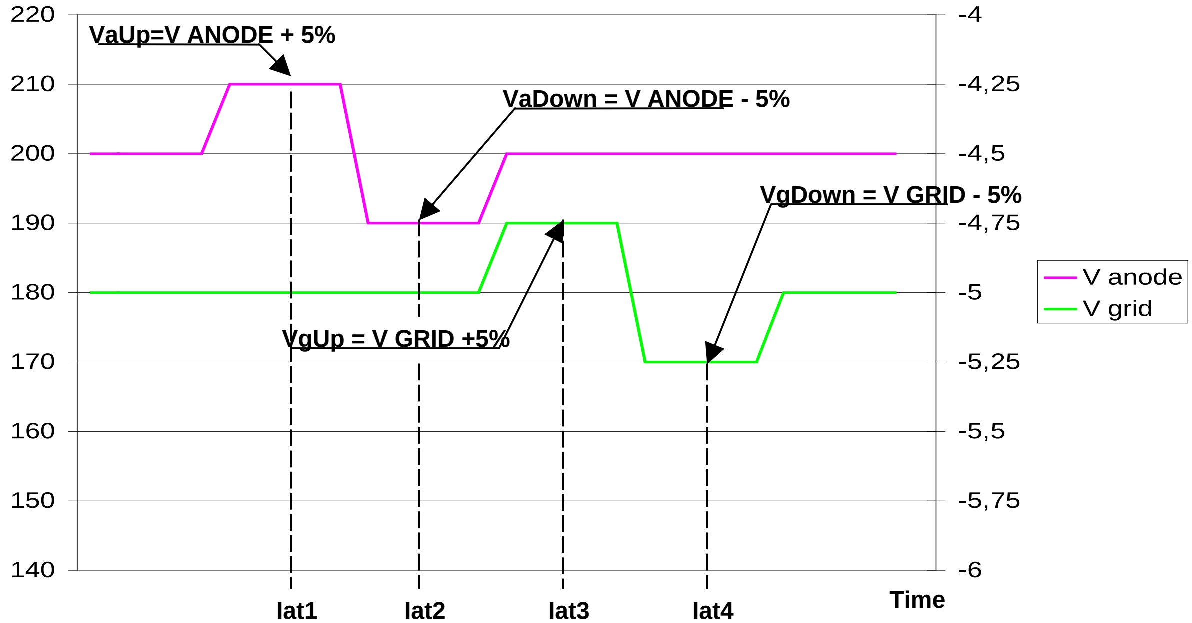
SOFIA CONTROL PANEL



$$GM = \frac{Iat3 - Iat4}{VgUp - VgDown}$$

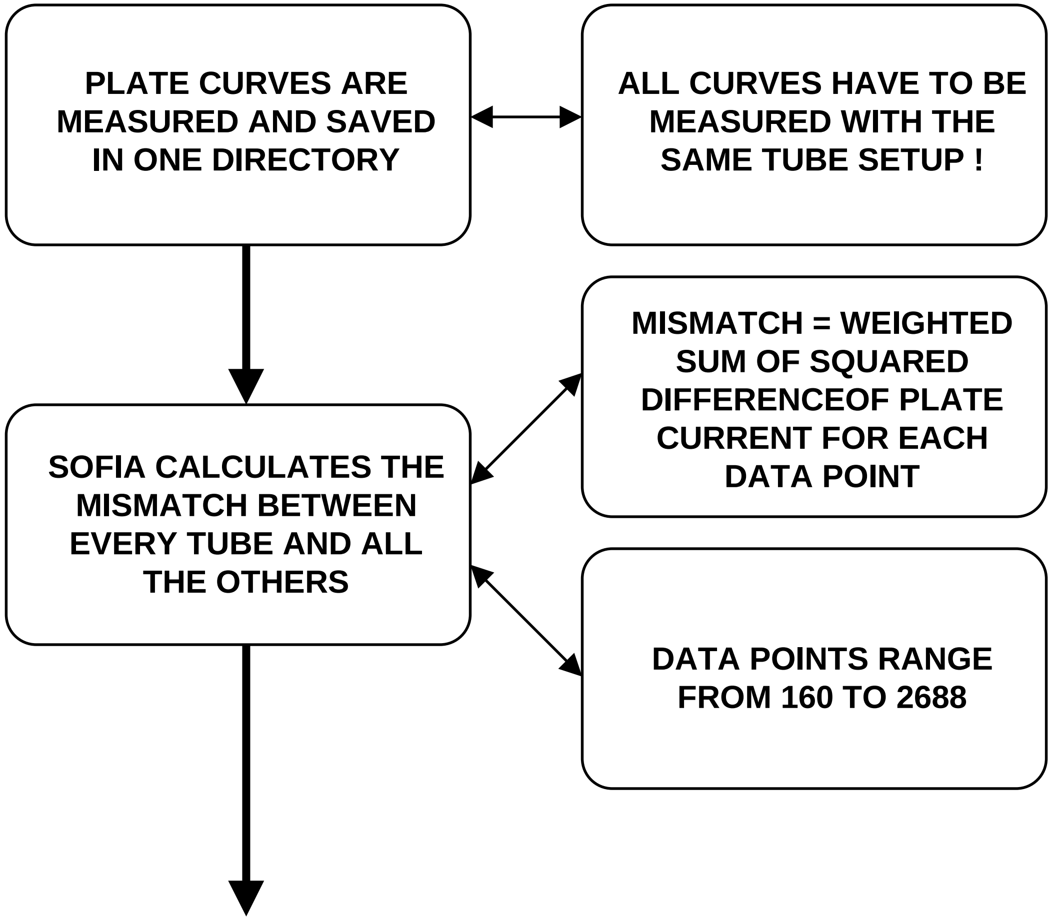
$$mu = rp \bullet GM$$

$$rp = \frac{Iat1 - Iat2}{VaUp - VaDown}$$



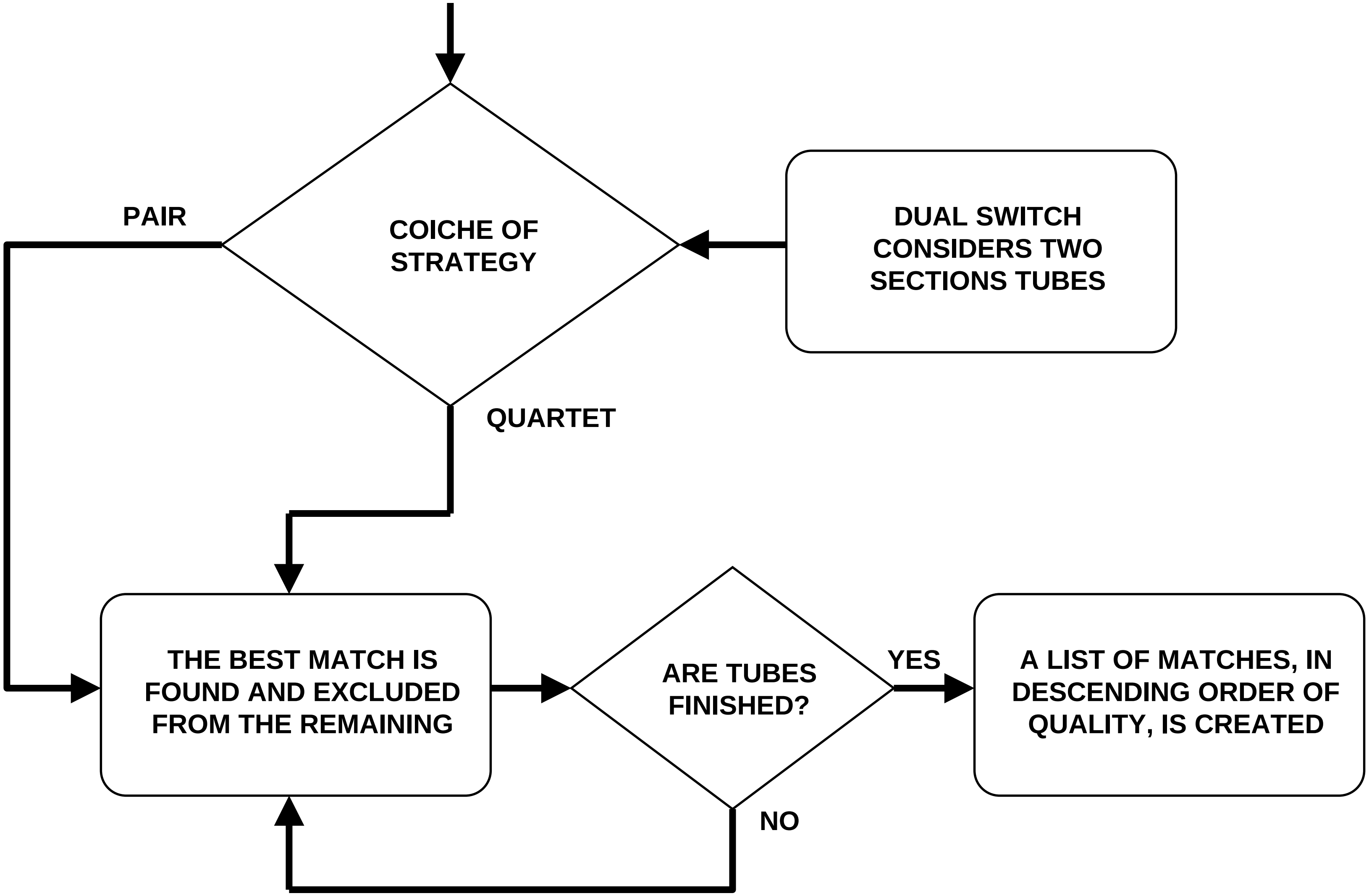
AUDIOMATICA

MATCH PROCEDURE - 1



AUDIOMATICA

MATCH PROCEDURE - 2



AUDIOMATICA

SOFIA MATCH TO PAIR

SOFIA - MATCHING TOOL

NAME 1	NAME 2	ERR	NAME 1	NAME 2	ERR	NAME 1	NAME 2	ERR
TUBE32.PT1	TUBE7.PT1	20	TUBE18.PT2	TUBE36.PT1	66	TUBE13.PT2	TUBE20.PT2	137
TUBE2.PT2	TUBE31.PT2	23	TUBE27.PT1	TUBE37.PT1	67	TUBE17.PT1	TUBE52.PT1	141
TUBE29.PT1	TUBE48.PT2	25	TUBE47.PT1	TUBE8.PT2	68	TUBE44.PT2	TUBE45.PT1	142
TUBE16.PT1	TUBE4.PT2	27	TUBE45.PT2	TUBE51.PT2	69	TUBE47.PT2	TUBE9.PT2	145
TUBE20.PT1	TUBE42.PT1	28	TUBE14.PT2	TUBE15.PT2	73	TUBE44.PT1	TUBE58.PT2	147
TUBE30.PT1	TUBE56.PT1	31	TUBE22.PT2	TUBE32.PT2	74	TUBE26.PT1	TUBE50.PT2	157
TUBE19.PT1	TUBE2.PT1	33	TUBE36.PT2	TUBE43.PT1	79	TUBE35.PT2	TUBE53.PT2	177
TUBE30.PT2	TUBE57.PT1	35	TUBE24.PT2	TUBE25.PT2	80	TUBE43.PT2	TUBE8.PT1	271
TUBE49.PT2	TUBE54.PT1	41	TUBE11.PT2	TUBE41.PT2	82	TUBE56.PT2	TUBE6.PT1	310
TUBE19.PT2	TUBE51.PT1	42	TUBE40.PT1	TUBE58.PT1	85	TUBE38.PT1	TUBE55.PT2	516
TUBE16.PT2	TUBE49.PT1	46	TUBE15.PT1	TUBE39.PT1	87			
TUBE1.PT1	TUBE52.PT2	48	TUBE26.PT2	TUBE46.PT2	89			
TUBE42.PT2	TUBE57.PT2	49	TUBE29.PT2	TUBE9.PT1	91			
TUBE33.PT2	TUBE40.PT2	52	TUBE34.PT1	TUBE54.PT2	93			
TUBE38.PT2	TUBE5.PT2	53	TUBE28.PT2	TUBE39.PT2	94			
TUBE11.PT1	TUBE22.PT1	54	TUBE13.PT1	TUBE25.PT1	95			
TUBE1.PT2	TUBE33.PT1	55	TUBE21.PT1	TUBE23.PT1	97			
TUBE31.PT1	TUBE48.PT1	56	TUBE50.PT1	TUBE7.PT2	98			
TUBE18.PT1	TUBE55.PT1	57	TUBE23.PT2	TUBE24.PT1	104			
TUBE12.PT2	TUBE21.PT2	58	TUBE17.PT2	TUBE27.PT2	105			
TUBE12.PT1	TUBE6.PT2	61	TUBE28.PT1	TUBE3.PT2	106			
TUBE10.PT1	TUBE10.PT2	63	TUBE46.PT1	TUBE53.PT1	115			
TUBE14.PT1	TUBE35.PT1	64	TUBE34.PT2	TUBE41.PT1	118			
TUBE37.PT2	TUBE4.PT1	65	TUBE3.PT1	TUBE5.PT1	129			

Calc | Match | Pair | Quartet | Dual | About | Export

FILE: pairnd DIRECTORY: BUGDIGI

AUDIOMATICA

SOFIA MATCH TO PAIR WITH DUAL

SOFIA - MATCHING TOOL

NAME 1	NAME 2	ERR	NAME 1	NAME 2	ERR	NAME 1	NAME 2	ERR
TUBE25.PT1	TUBE25.PT2	23	TUBE2.PT1	TUBE2.PT2	255	TUBE43.PT1	TUBE43.PT2	600
TUBE38.PT1	TUBE38.PT2	28	TUBE42.PT1	TUBE42.PT2	262	TUBE33.PT1	TUBE33.PT2	607
TUBE27.PT1	TUBE27.PT2	48	TUBE57.PT1	TUBE57.PT2	264	TUBE54.PT1	TUBE54.PT2	732
TUBE10.PT1	TUBE10.PT2	63	TUBE3.PT1	TUBE3.PT2	269	TUBE21.PT1	TUBE21.PT2	745
TUBE45.PT1	TUBE45.PT2	77	TUBE52.PT1	TUBE52.PT2	271	TUBE35.PT1	TUBE35.PT2	780
TUBE22.PT1	TUBE22.PT2	92	TUBE34.PT1	TUBE34.PT2	273			0
TUBE47.PT1	TUBE47.PT2	96	TUBE19.PT1	TUBE19.PT2	277			0
TUBE37.PT1	TUBE37.PT2	110	TUBE48.PT1	TUBE48.PT2	289			0
TUBE11.PT1	TUBE11.PT2	112	TUBE41.PT1	TUBE41.PT2	303			0
TUBE7.PT1	TUBE7.PT2	115	TUBE13.PT1	TUBE13.PT2	306			0
TUBE14.PT1	TUBE14.PT2	117	TUBE8.PT1	TUBE8.PT2	347			
TUBE31.PT1	TUBE31.PT2	119	TUBE30.PT1	TUBE30.PT2	348			
TUBE28.PT1	TUBE28.PT2	124	TUBE55.PT1	TUBE55.PT2	349			
TUBE4.PT1	TUBE4.PT2	140	TUBE56.PT1	TUBE56.PT2	369			
TUBE1.PT1	TUBE1.PT2	142	TUBE20.PT1	TUBE20.PT2	417			
TUBE26.PT1	TUBE26.PT2	155	TUBE50.PT1	TUBE50.PT2	432			
TUBE24.PT1	TUBE24.PT2	157	TUBE6.PT1	TUBE6.PT2	461			
TUBE9.PT1	TUBE9.PT2	167	TUBE16.PT1	TUBE16.PT2	467			
TUBE36.PT1	TUBE36.PT2	171	TUBE44.PT1	TUBE44.PT2	473			
TUBE23.PT1	TUBE23.PT2	188	TUBE49.PT1	TUBE49.PT2	485			
TUBE18.PT1	TUBE18.PT2	195	TUBE15.PT1	TUBE15.PT2	501			
TUBE17.PT1	TUBE17.PT2	212	TUBE39.PT1	TUBE39.PT2	516			
TUBE12.PT1	TUBE12.PT2	228	TUBE5.PT1	TUBE5.PT2	554			
TUBE46.PT1	TUBE46.PT2	241	TUBE53.PT1	TUBE53.PT2	574			

Calc | Match | Pair | Quartet | Dual | About | Export

FILE: pair DIRECTORY: BUGDIGI

AUDIOMATICA

SOFIA MATCH TO QUARTET WITH DUAL

SOFIA - MATCHING TOOL

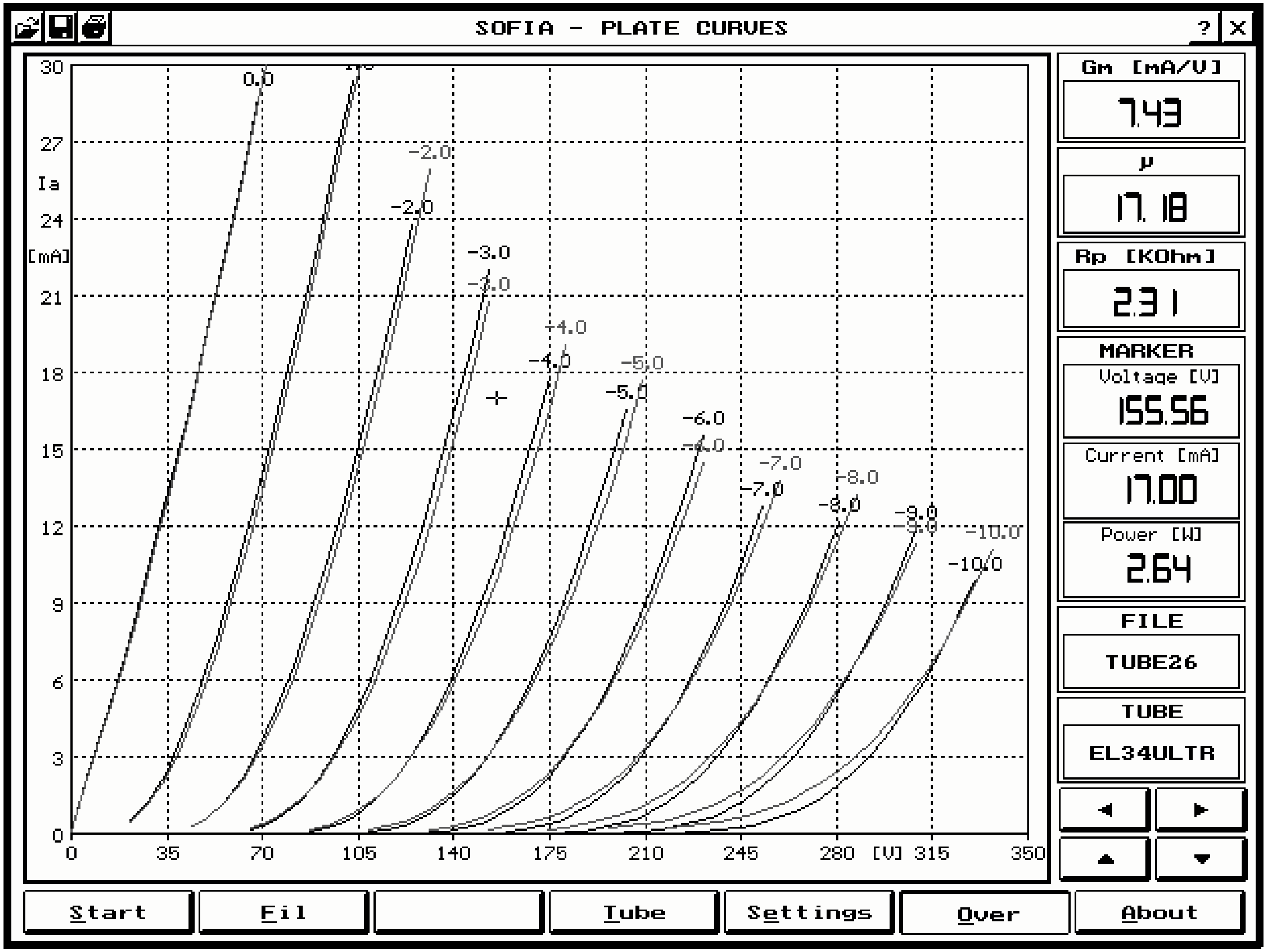
NAME 1	NAME 2	NAME 3	NAME 4	ERR	NAME 1	NAME 2	NAME 3	NAME 4	ERR
TUBE11.PT1	TUBE11.PT2	TUBE38.PT1	TUBE38.PT2	75	TUBE3.PT1	TUBE3.PT2	TUBE53.PT1	TUBE53.PT2	404
TUBE27.PT1	TUBE27.PT2	TUBE37.PT1	TUBE37.PT2	76	TUBE33.PT1	TUBE33.PT2	TUBE39.PT1	TUBE39.PT2	476
TUBE10.PT1	TUBE10.PT2	TUBE14.PT1	TUBE14.PT2	84	TUBE21.PT1	TUBE21.PT2	TUBE43.PT1	TUBE43.PT2	562
TUBE24.PT1	TUBE24.PT2	TUBE25.PT1	TUBE25.PT2	91	TUBE16.PT1	TUBE16.PT2	TUBE54.PT1	TUBE54.PT2	582
TUBE29.PT1	TUBE29.PT2	TUBE51.PT1	TUBE51.PT2	107					0
TUBE22.PT1	TUBE22.PT2	TUBE31.PT1	TUBE31.PT2	109					
TUBE36.PT1	TUBE36.PT2	TUBE47.PT1	TUBE47.PT2	121					
TUBE4.PT1	TUBE4.PT2	TUBE7.PT1	TUBE7.PT2	130					
TUBE1.PT1	TUBE1.PT2	TUBE45.PT1	TUBE45.PT2	133					
TUBE40.PT1	TUBE40.PT2	TUBE58.PT1	TUBE58.PT2	144					
TUBE26.PT1	TUBE26.PT2	TUBE28.PT1	TUBE28.PT2	146					
TUBE17.PT1	TUBE17.PT2	TUBE32.PT1	TUBE32.PT2	164					
TUBE18.PT1	TUBE18.PT2	TUBE42.PT1	TUBE42.PT2	179					
TUBE12.PT1	TUBE12.PT2	TUBE19.PT1	TUBE19.PT2	189					
TUBE2.PT1	TUBE2.PT2	TUBE52.PT1	TUBE52.PT2	192					
TUBE30.PT1	TUBE30.PT2	TUBE57.PT1	TUBE57.PT2	216					
TUBE8.PT1	TUBE8.PT2	TUBE9.PT1	TUBE9.PT2	219					
TUBE34.PT1	TUBE34.PT2	TUBE41.PT1	TUBE41.PT2	231					
TUBE13.PT1	TUBE13.PT2	TUBE23.PT1	TUBE23.PT2	238					
TUBE48.PT1	TUBE48.PT2	TUBE55.PT1	TUBE55.PT2	267					
TUBE44.PT1	TUBE44.PT2	TUBE46.PT1	TUBE46.PT2	296					
TUBE49.PT1	TUBE49.PT2	TUBE50.PT1	TUBE50.PT2	332					
TUBE5.PT1	TUBE5.PT2	TUBE56.PT1	TUBE56.PT2	347					
TUBE15.PT1	TUBE15.PT2	TUBE20.PT1	TUBE20.PT2	391					

Calc | Match | Pair | Quartet | Dual | About | Export

FILE: quartet DIRECTORY: BUGDIGI

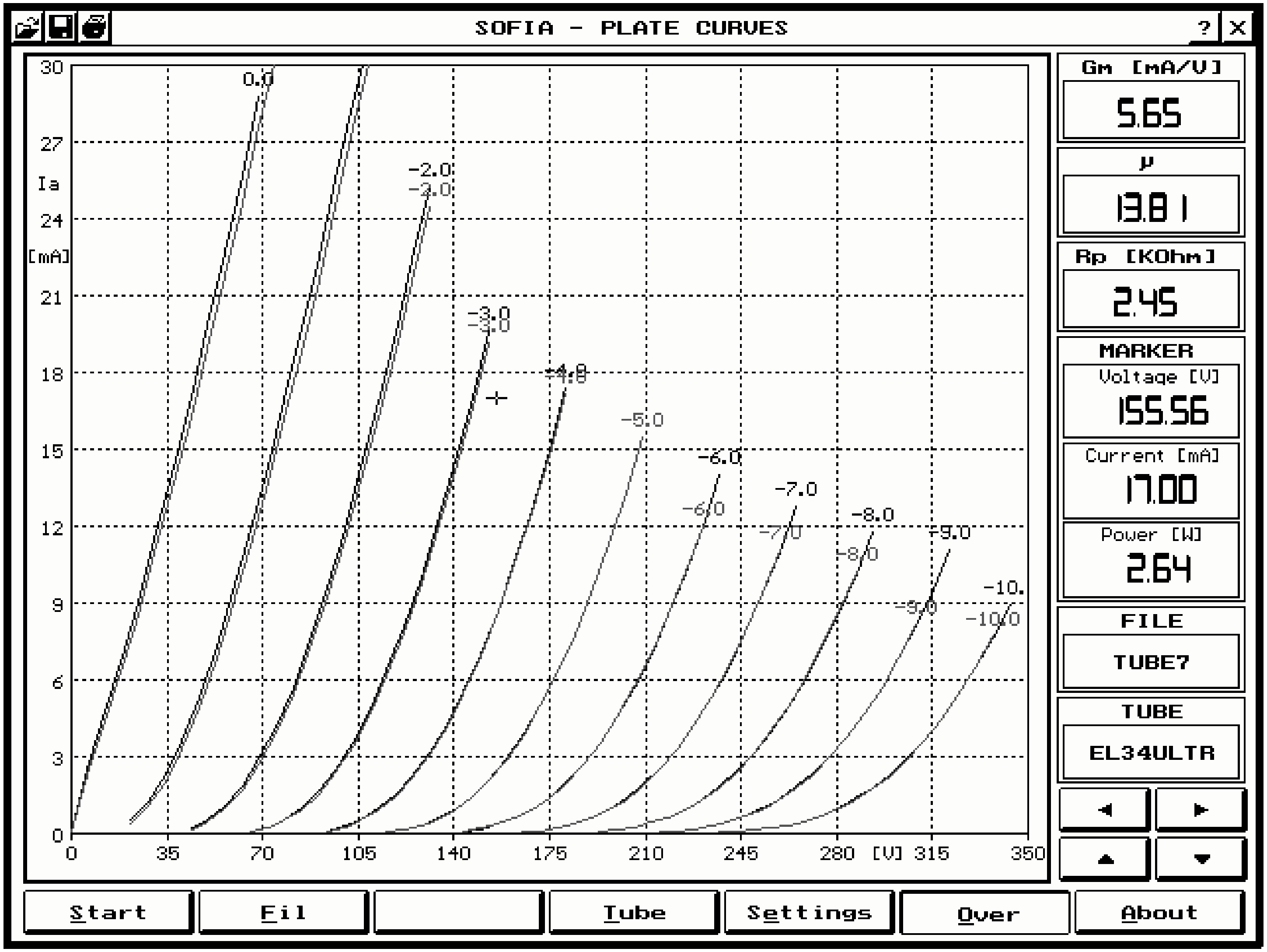
AUDIOMATICA

SOFIA MATCH WITH ERROR=150



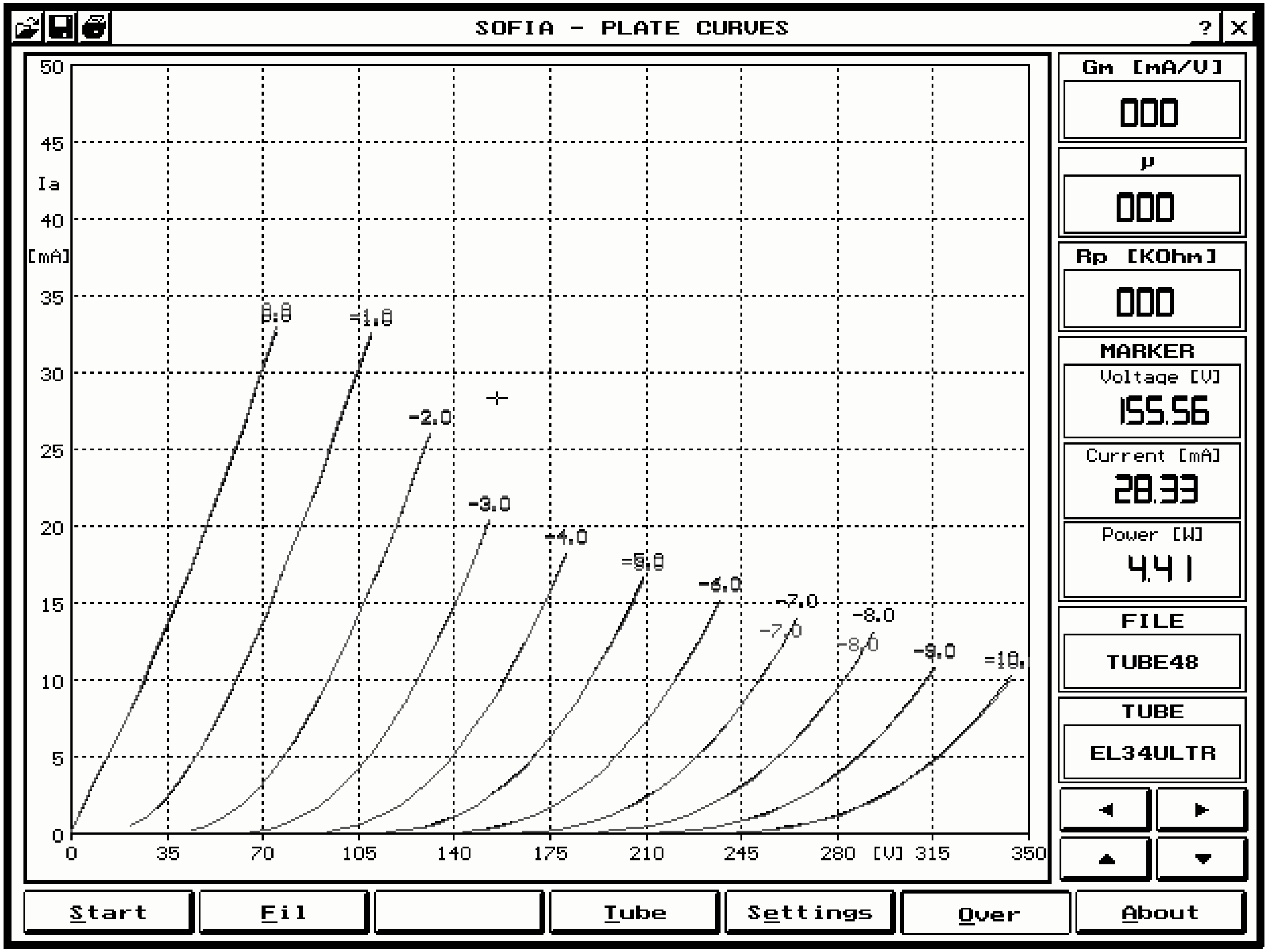
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SOFIA MATCH WITH ERROR=100



AUDIOMATICA

SOFIA MATCH WITH ERROR=25



AUDIOMATICA

ACCEPTABLE ERROR VALUE

IS LEFT TO THE USER EXPERIENCE

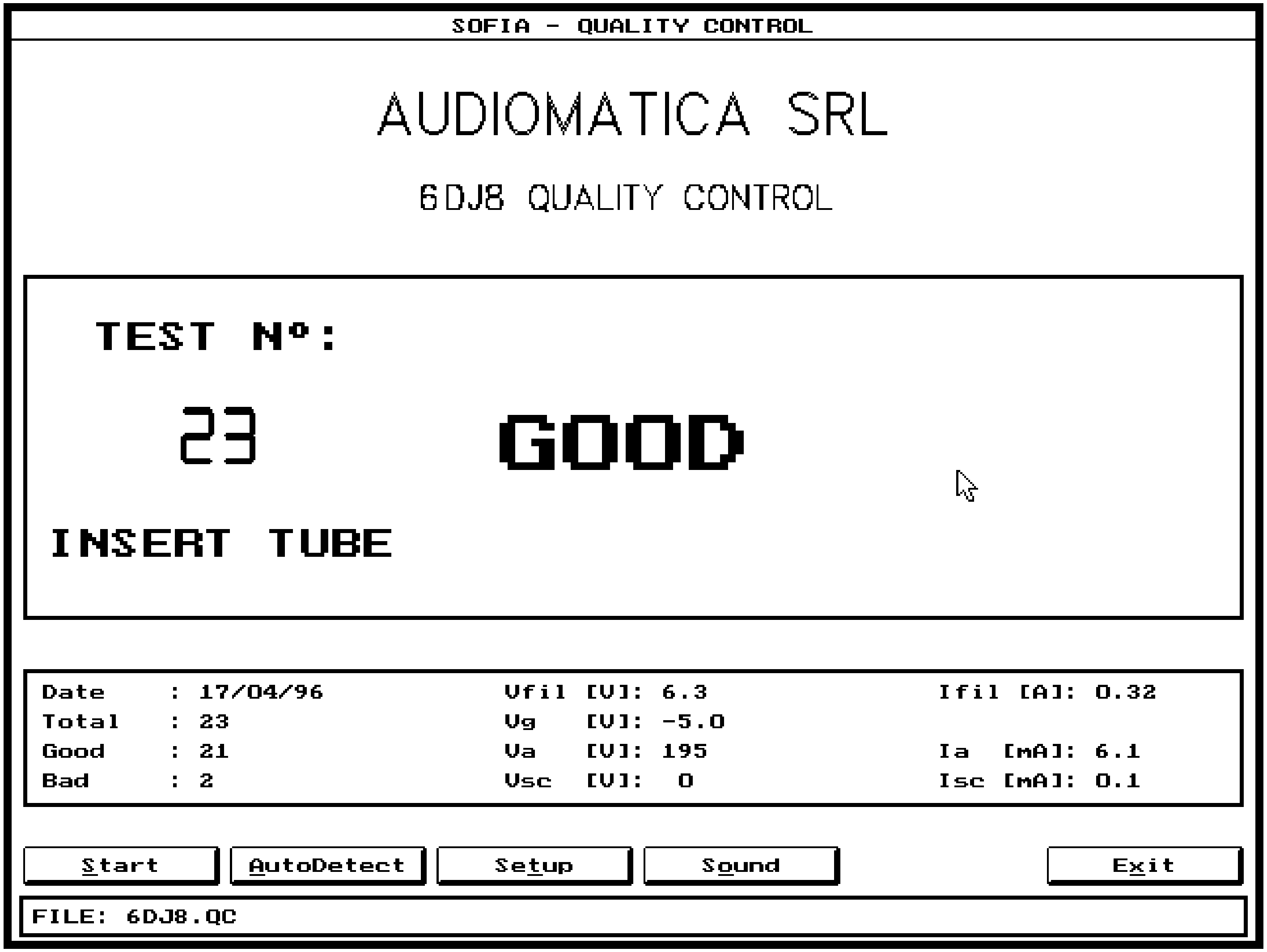
DESIGNERS SHOULD BASE THEIR CHOICE ON PRICE AND APPLICATION

RETAILERS SHOULD BASE THEIR CHOICE ON PRICE AND AVAILABILITY

AS AN ABSOLUTE CRITERIA ERROR<100 SHOULD BE CONSIDERED A VERY GOOD MATCH

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SOFIA AND QUALITY CONTROL



SOFIA AND QUALITY CONTROL

```
;THIS IS A SAMPLE QUALITY CONTROL SETUP FILE ('.QC' EXTENSION)

COMPANY=AUDIOMATICA SRL

TITLE=6DJ8 Quality Control

VFIL=6.3              ; [Volts]

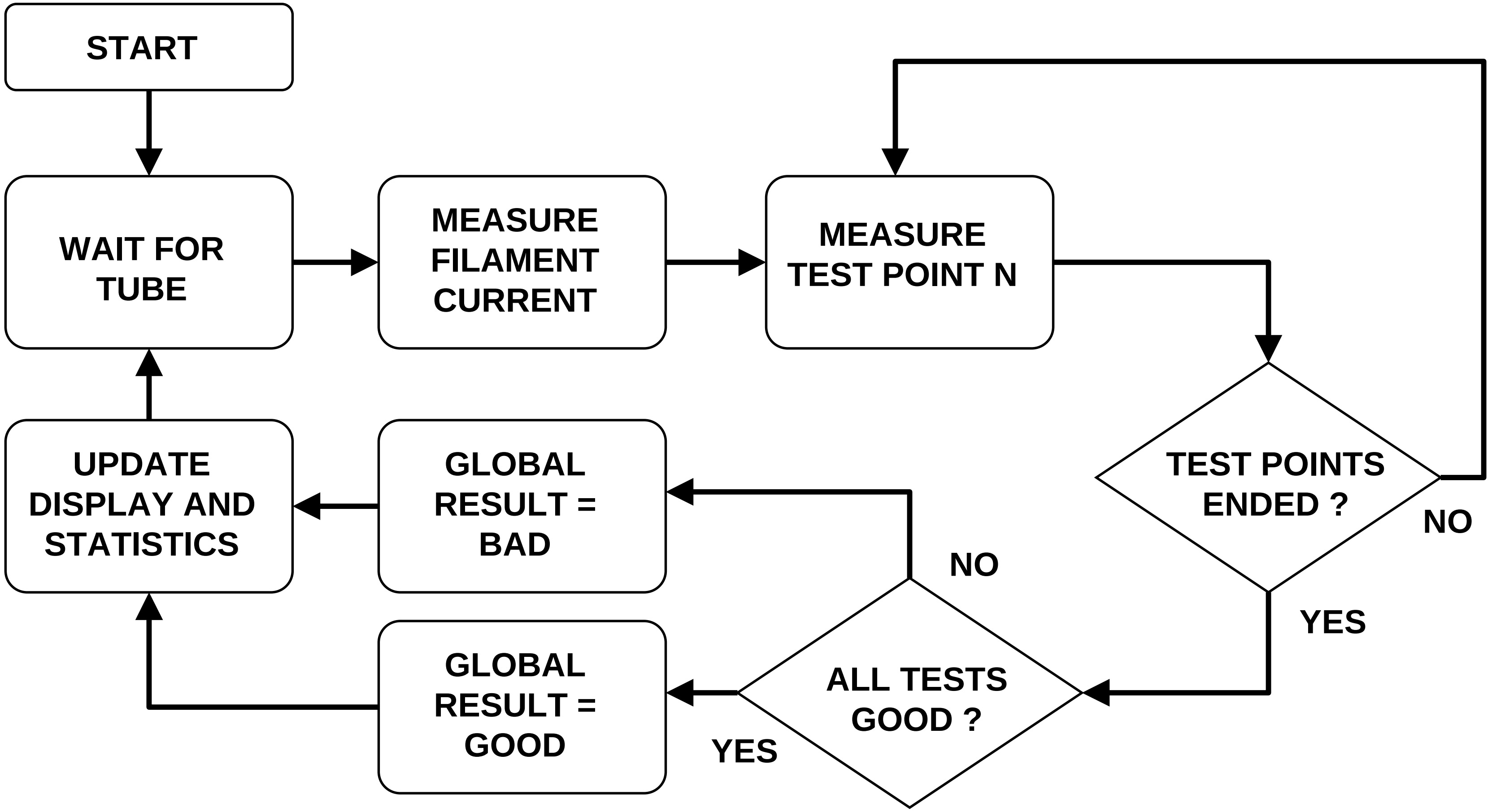
IFIL=0.33             ; [Amperes]
IFTOL=10              ; [%]

AUTODETECT=0          ; 0=off 1=on
HEATINGDELAY=1        ; [s]

[DATA]
VGRID[V]  VANODE[V]  IANODE[mA]  IATOL(%)  VSCREEN(V)  ISCREEN(mA)  ISTOL(%)
-4        190        14          20        0           0            0
-5        195        7           20        0           0            0
```


AUDIOMATICA

SOFIA AND QUALITY CONTROL



AUDIOMATICA